The Electrical Industry's Weekly Magazine

March 11, 1957

Electrical World

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Designing Tomorrow's Transmission

...Page 91

Two A-Power Programs? ... Page 78

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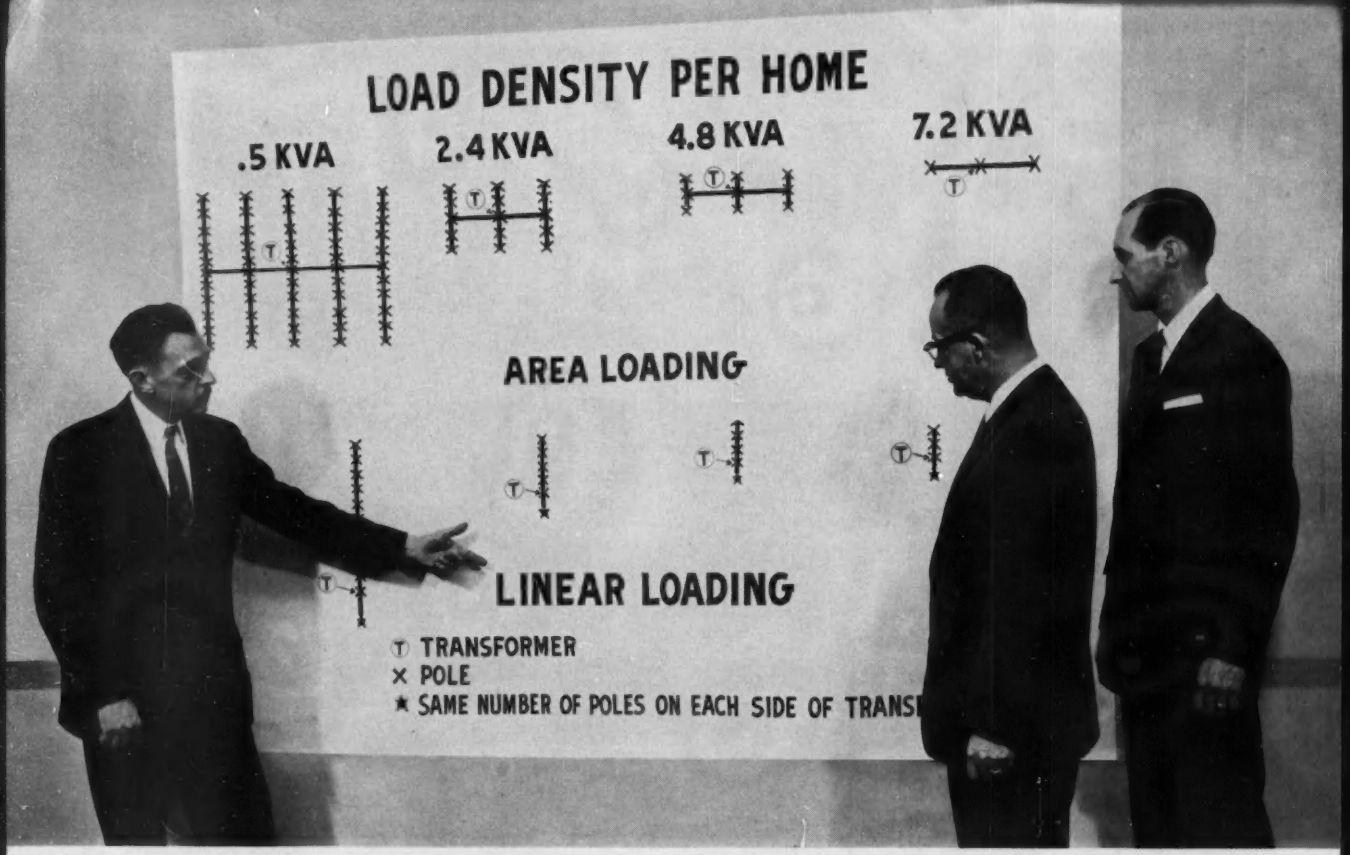
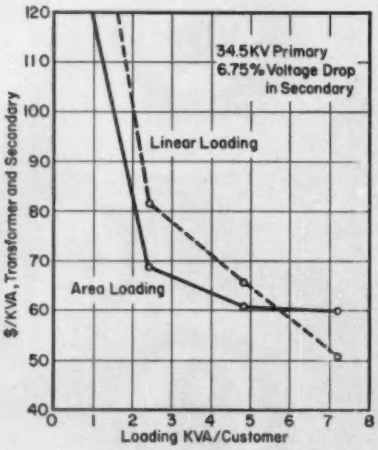


LOAD AREA GEOMETRY shows linear loading more economical for future residential secondary systems. F. C. Van Wormer, G-E Engr. who developed the theory, discusses it with New York State Electric & Gas Supervising Distribution Engr. H. L. Livingood and G.E.'s P. Kartluke.

On tomorrow's secondary distribution systems...

Which will be most economical, linear or area loading?



LOWER COSTS for linear loading beyond density of about 5.75 kva per customer are evidenced by this graph. Savings could be achieved at a lower density on a 12 kv primary system.

As residential load densities increase, more and more complex engineering calculations are required in determining how to supply higher loads on residential secondary distribution systems. These calculations may be greatly simplified by applying a General Electric load area geometry theory. This theory provides a quick, accurate engineering tool for use in studying any utility's residential secondary system.

Load area geometry predicts (see chart above) as residential load density increases, the length of laterals in the area system decreases much more rapidly than the length of mains. Thus, area loading reverts to an impractical type of linear loading.

A recent economic analysis of residential secondary distribution systems confirmed the predictions of load area geometry. It showed (see chart left) although area loading is economical for light load densities, only linear loading offers economic superiority for the heavier loads forecast for tomorrow.

New York State Electric & Gas power distribution system planners have found load area geometry theory valuable in analyzing circuit arrangements. In applying this theory to their system they have saved considerable engineering time and have developed more flexible and practical distribution systems capable of expanding with rising load density.

For more information on load area geometry, write General Electric Co., Section 301-349, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 147, No. 10 MARCH 11, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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ALUMINUM-SHEATHED CABLES

...light ...strong ...smaller diameter

A seamless aluminum sheath over Okonite cables provides a durable, conduit-type covering of high tensile strength. Yet this aluminum sheath is easily worked with standard conduit tools. It can be bent around obstructions . . . terminated at boxes, transformers, and the like . . . trained in trays . . . or supported by conventional brackets and cable clamps. Standard fittings are available. This low-cost alternate to rigid conduit is available with virtually any Okonite insulation such as rubber, plastic or varnished cambric.

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. . . *from the publisher*

With the whole world atom-conscious, prospects of nuclear power generation excite not just utility people, but the general public, too. And amidst all the hub-bub, atomic power has become the "glamor boy" of the power business.

But what about other phases of utility engineering? Transmission, for instance. Where is it headed?

That's what Electrical World editors too wanted to know. So they went to the planning rooms of the industry to find out. The result is this issue's special report, "Designing Tomorrow's Transmission," page 91.

In it you'll read of the first narrow-base steel tower design to be applied to an extra-high voltage line—and the money and materials it will save. This line hasn't been built. In fact, it hasn't even been announced. But it is on the drawing boards of Commonwealth Associates, Jackson, Mich., for one of its client utilities.

Another feature: First design details of the new 230-kv line which will wheel power out of the giant St. Lawrence project across New York State.

Both are stories you will read first in Electrical World. They're the outcome of EW editors' wide contacts in the engineering fraternity—the confidences they enjoy among well-placed sources.

Fischer Black

ABP **ELECTRICAL WORLD**

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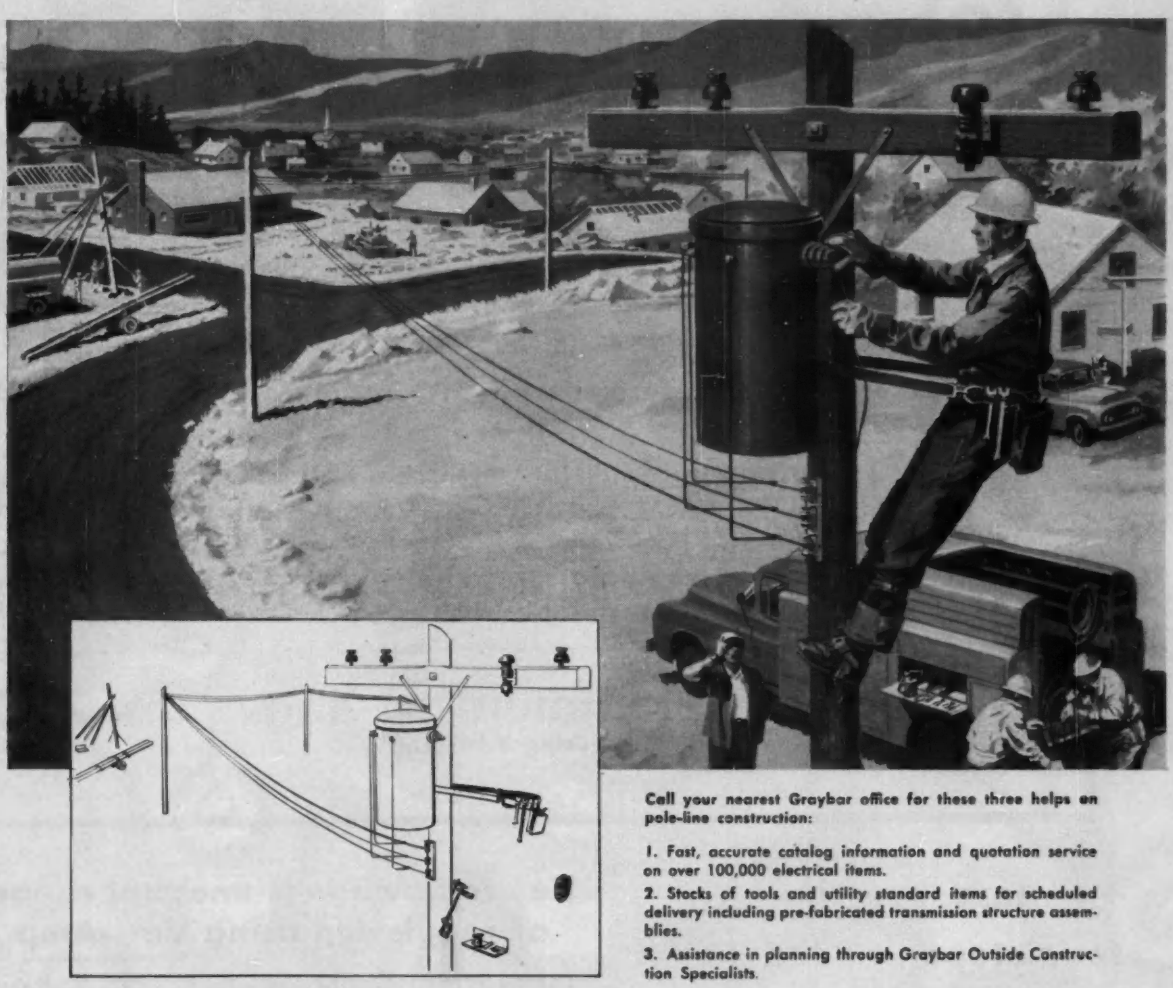

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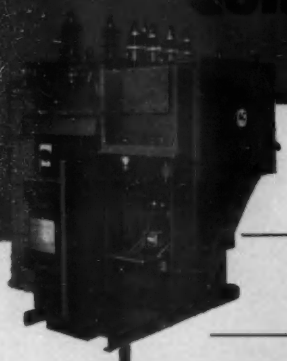
How regulators

Compare cost of LTC transformers



LTC on transformer with ±10% regulation	$12,287
3 Distribution regulators with conventional +10% −10% regulation	$11,670
3 Distribution regulators provide +10% −5% system regulation using *VARI-AMP*	$ 7,572
Maximum savings (using *VARI-AMP*)	$ 4,715

Here are the four steps needed to make this comparison:

1. **Select substation size.**
2. **Determine percent regulation required.**
3. **Select proper size regulating unit based either on current or kva, and range of regulation required.**
4. **Compare cost of LTC portion of transformer and 3 Allis-Chalmers distribution regulators.**

In this example, the substation size is 3750 kva, 164 amperes, 13,200 volts, self-cooled. Regulation required is +10% −5%.

Key to Savings is unequal range of regulation using Vari-Amp

Regulators or LTC could be provided for ±10% regulation. But there's a money saving way using *Vari-Amp* where less than ±20% regulation is required.

In this case, regulation needs are figured either on basis of setting permanent taps of transformer up 5%, or using an alternate voltage on low voltage winding to provide a 5% boost. Then only a 5% raise from the regulator is needed. The transformer raises voltage 5%; regulator raises voltage 5% . . . a net raise of 10%.

This requires regulators to carry 3750 through kva or 164 amperes at the 5% *Vari-Amp* position.

On minimum load the transformer raises voltage 5%, regulator lowers voltage 10%, which gives a net result of −5%. The regulator is allowed to go to −10% because load current has dropped below the 10% current rating of the regulator.

The selection: regulators rated 76.2 kva, 7620 volts, 160 amperes. Comparing costs shows a saving of $4715 using Allis-Chalmers distribution regulators with *Vari-Amp*.

See what you can save! Get a bid on A-C regulators next time you figure a substation. Ask your nearby A-C office for Key to Low Cost Regulation, No. A-5307, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

save $4715

and regulators

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Originators of:

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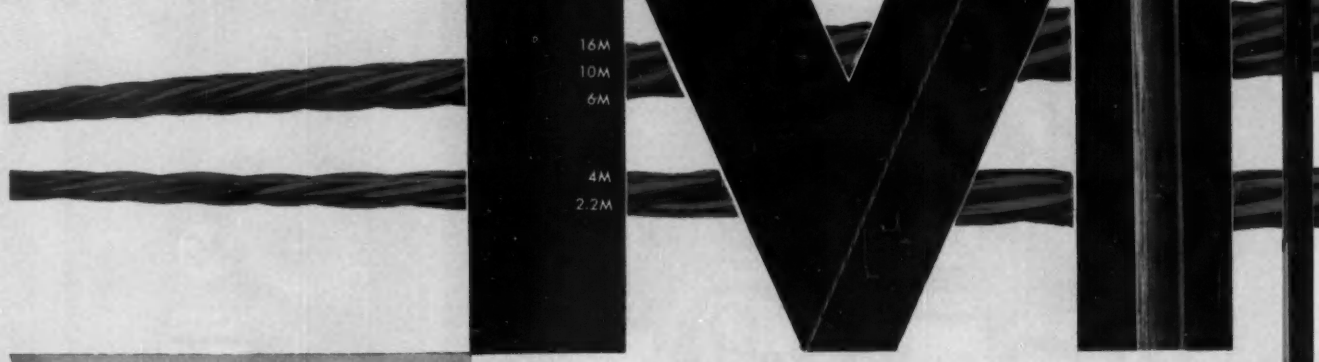
TYPE M



New **HIGH-STRENGTH STRAND** *developed by Copperweld research*

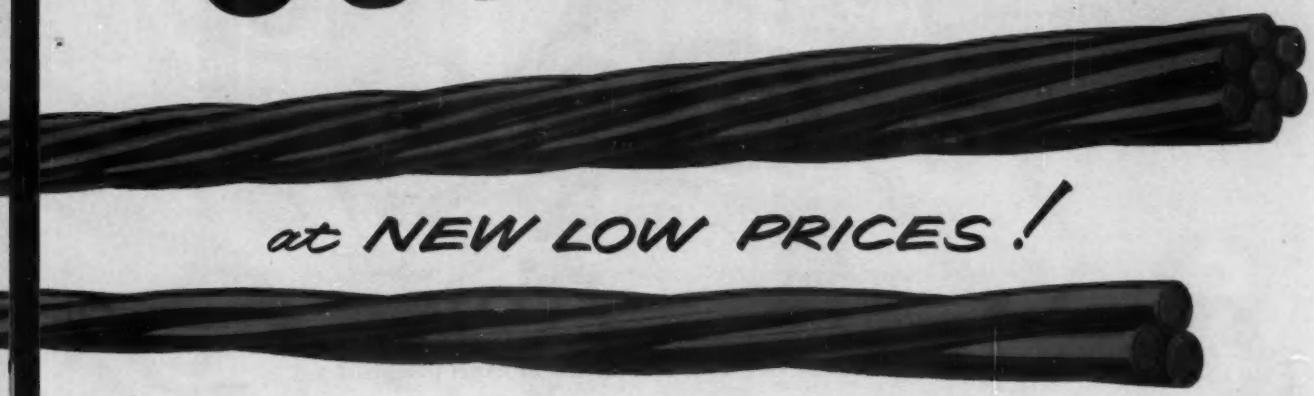
New **STREAMLINED TECHNIQUES** *for guy strand production*

New **ECONOMY**—*lower first cost, lowest over-all cost*

The SAME **PROVED DEPENDABILITY AND LONG LIFE...**

GUY STRAND since 1915...

GUY STRAND



at NEW LOW PRICES!

More than 40 years ago, Copperweld* introduced the first permanently non-rusting, high-strength guy strand. Because of its long, maintenance-free life, that strand has always been lowest in annual cost.

Now, with the new Copperweld Type M Guy Strand, first cost, too, has been reduced all along the line. The new low prices are the result of two recent Copperweld developments: a new, high-strength strand made especially for guy use, and new guy strand production techniques. And you still get the same long life, the same freedom from maintenance, because Type M Guy Strand is still Copperweld—each wire has a thick copper sheath inseparably molten-welded to an alloy steel core.

Copperweld Type M Guy Strand is available in 5 strengths: 2.2M, 4M, 6M, 10M and 16M. Pliable and easy to handle, it can be readily bent, served, moused or clamped. And, because of the molten-weld, the copper covering will not crack, flake or peel.

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*Trade Mark

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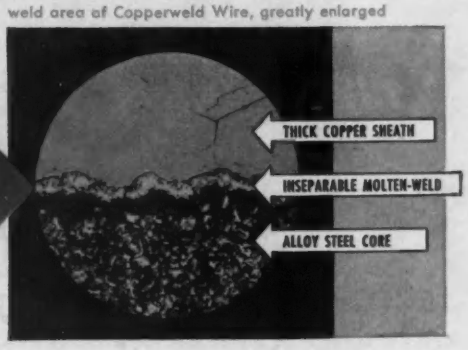
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

weld area of Copperweld Wire, greatly enlarged



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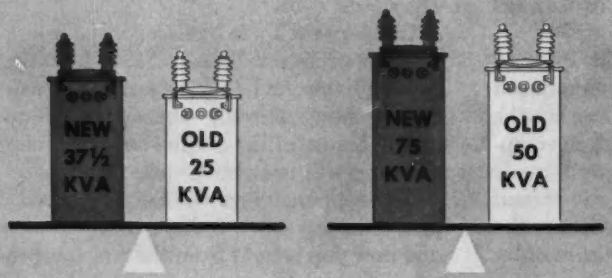
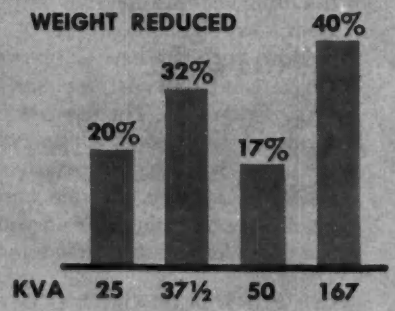
Take these popular distribution transformer KVA sizes for example:"

During the last few years Kuhlman distribution transformers have been made lighter, smaller and shorter. They are easier to handle, require less storage space, and in the higher KVA ratings save the cost of larger poles.

This modern trend to lighter, more compact design was originally started by the Kuhlman Bent Iron Core more than 20 years ago. Today refinement of the "Bent Iron" principal has made even greater improvements possible. For example:





The 75 KVA transformer now requires the same pole as the old 50 KVA—the 100 KVA weighs approximately the same as the old 75 KVA. In fact, all popular ratings are substantially lighter, as shown in the above chart.

* KUHLMAN *"Salesman of the Week"*

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OLD 167 KVA NEW 167 KVA

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- ★ Designed to replace a 75 or 100 KVA unit.

Height has, also, been reduced. The most outstanding example is the 167 KVA which is 31 inches shorter and weighs around 1600 pounds. This unit can now be pole mounted in place of a 75 or 100 KVA unit to give additional capacity without the extra cost of installing heavier poles or platforms.

The 167 is only one of the many ways Kuhlman is meeting the need for shorter, lighter transformers. Ask for our price list PL-200A and check the latest in Kuhlman weights and dimensions.

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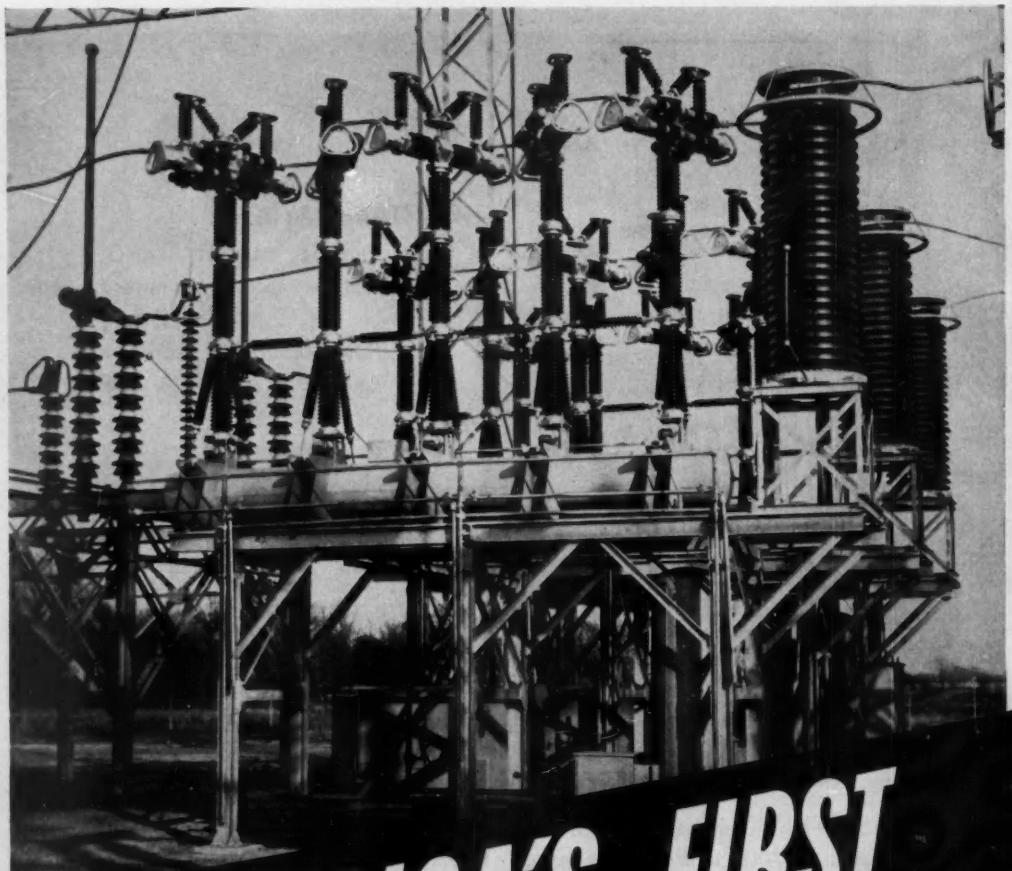

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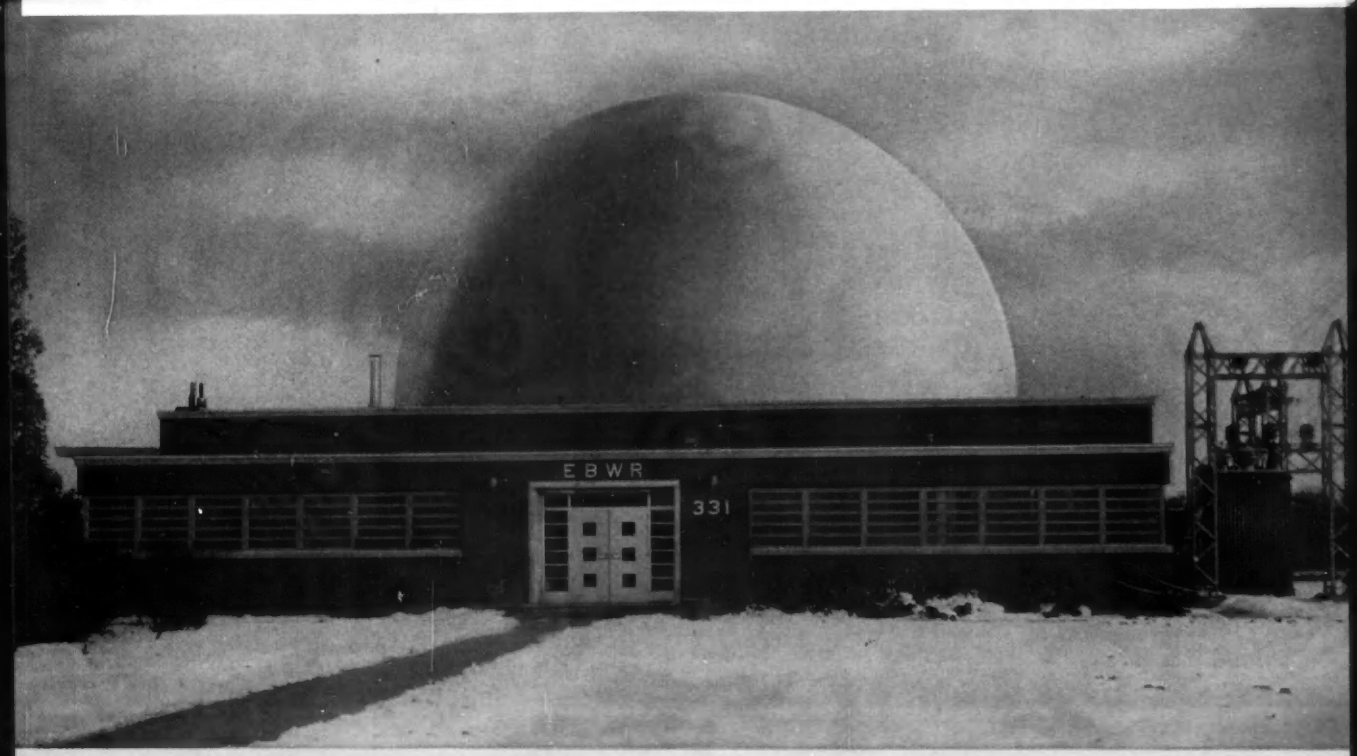

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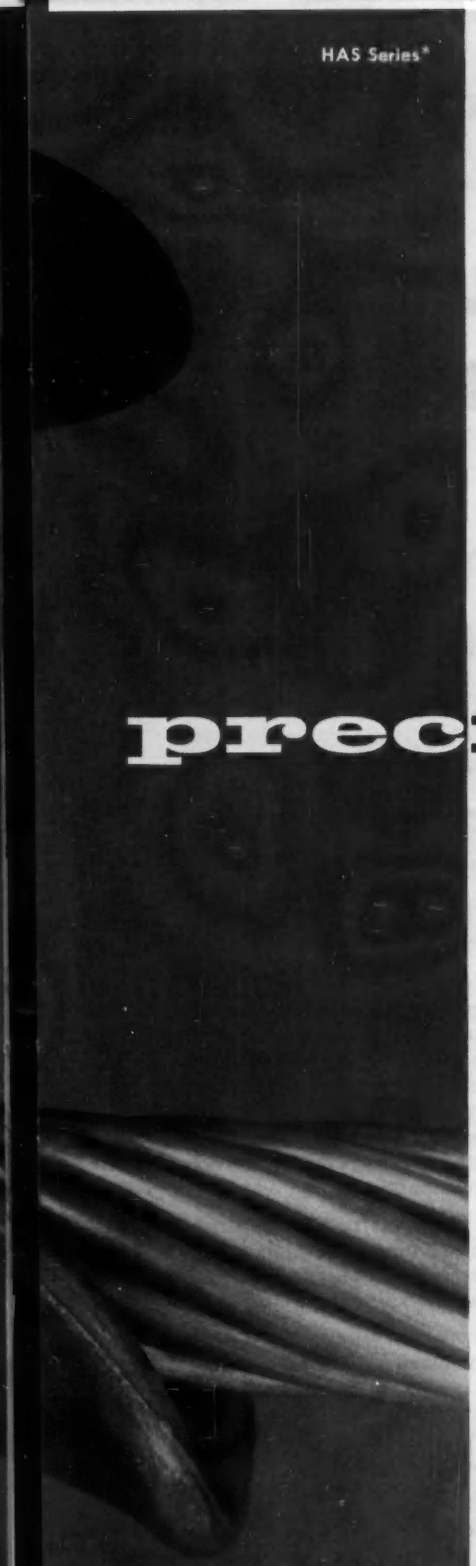

precision...

Power loss is practically eliminated with Anderson's Suspension Clamps. They are precision engineered to permit dual use . . . suspension as well as angle pull off. Specific features were engineered to allow widest range of conductor sags. Light weight construction reduces conductor damage.

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an Off-the-Shelf

AUTOMATIC TRANSFER PANEL

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NEWS-SCOPE

FUTURE NEWS ▶ **New distribution and high voltage switchgear soon to be announced** will make a major contribution to line switching flexibility.

Prospect grows that the National Rural Electric Cooperative Association will seek to amend the REA Act to permit integration of municipal and co-op systems . . . Also look for stepped up national public relations program on the part of the co-ops.

LATE NEWS ▶ **Pittsburgh Consolidation Coal's 108-mile coal pipeline is jammed.** Cleveland Electric Illuminating on receiving end reports no coal has come through yet. Last report said 400 tons, dispatched in pipeline tests, were stuck 25 miles from the strip mine at Georgetown, Ohio. A 30-man crew reportedly was drilling holes in the line to find the bottleneck.

President Eisenhower supports "compromise" bill for Niagara development. The measure, submitted by the two New York Senators and Rep W. E. Miller, proposes N. Y. Power Authority construction without federal preference.

In accordance with previously laid plans, two coffer dams were breached above Idaho Power Co's Brownlee project to permit heavy water runoff. There was no damage to the Brownlee works.

NRECA special resolution backs Congressional investigation of credit and interest policies of the Treasury and Federal Reserve System.

Wisconsin Public Service takes first place in 1956 National Safety Contest for combination utilities. Their record of 0.27 accidents per million manhours worked barely topped New Orleans Public Service's 0.28.

House and Senate interior and insular affairs subcommittee begins work on Hells Canyon bills. Under consideration were federal high dam plans by Rep Gracie Pfost (D-Idaho) and Sen Wayne Morse (D-Ore.). Only change from 1956 is support of plan from Govs. A. D. Rosellini (Wash.) and R. D. Holmes (Ore.).

AEC shuts down experimental submarine reactor operating at West Milton (N. Y.) since 1955. The prototype of Seawolf's sodium-cooled reactor has sold byproduct electricity to Niagara Mohawk at 3 mills per kwhr. During plant's life, 765,000 kwhr of the 2.3 million kwhr produced went to NMP.

Georgia Power begins service to 38,200 new customers in 20 south Georgia counties as its purchase of Georgia Power & Light becomes official. The $11.2-million acquisition, paid to Florida Power Corp (GP&L's parent), spread Georgia Power over virtually the entire state.

Virginia Electric & Power has purchased Roanoke Utilities Co which serves 786 customers in Manteo and Wanchese, N. C. Acquisition is subject to approval of regulatory bodies and a franchise in Manteo.

Congratulations . . . J. William Bennett has been elected vice president-engineering for Western Massachusetts Electric. Others advanced were Marlowe G. Moses to chief engineer and Harold Perry to general purchasing agent . . . New vice president of General Nuclear Engineering is John W. West, formerly associate director of Argonne National Lab's reactor engineering division.

Ladenburg, Thalmann & Co group made winning bid of 14.8¢ per share for underwriting compensation for purchase of any unsubscribed shares of the 549,324 shares of Consumers Power Co common stock not subscribed on the offer to the company's stockholders and employees at $42.75 a share.

TRANSMISSION ▶ **Snowballing demands for electric power by every class of customer** poses a number of tough, and closely interrelated, problems for the transmission engineer. He must devise economical methods of transporting greater quantities of energy over long distances with minimum use of right-of-way space. Shift to higher voltages is one part of the answer, and the EHV 345-kv system finds increasing acceptance.

Another part of the answer lies in improved line and structure design, to which we devote a special report in this issue. The report, titled "Designing Tomorrow's Transmission," consists of four articles selected to give you a look at innovations that seem certain to figure in future transmission design **(p 91).**

To trim tower costs, increase capability, and hold radio influence within satisfactory limits, engineers of Commonwealth Associates have designed a bundled conductor 345-kv line using narrow base steel structures. By modifying broken wire requirements, they have greatly reduced tower weight **(p 92).**

To eliminate dead-end trouble, consulting engineers for the New York State Power Authority claim to have avoided the need for any dead-ending along 71-mile, 230-kv line that will carry power from the St. Lawrence project to load centers. Structures will be wood pole H-frames constructed entirely of round members, except that steel towers will be used in area near station **(p 96).**

To cut costs on its 83-mile, 230-kv Jamestown-Fargo (N. D.) line, the Bureau of Reclamation specified smaller, lighter steel towers and reduced the insulation level. This provides a savings of up to 23.6% in steel and cuts number of insulators from 16 to 14 in suspension strings. It also reduces the critical positive impulse flashover voltage from 1,425 to 1,265 kv. Fast-reclosing circuit breakers are expected to compensate for the lower insulation level, thus keeping lightning outages to an acceptable minimum **(p 100).**

To conserve precious right-of-way space, the Salt River Power District in Arizona is testing a 161-kv line on single pole structures having wishbone-type crossarms. If it proves out, it would be suitable for the narrow rights-of-way along primary roads and in semi-urban areas **(p 98).**

EVENTS ▶ **Prospects are for a showdown on Niagara power development this year.** The six-year-old controversy surrounding development of 1.8 million kw of power at the scenic falls is now narrowed to a single issue—preference in sale of power. If we were betting, we'd wager that Congress will give the go-ahead to the Power Authority of the State of New York, permitting it to give marketing preference to rural and domestic customers **(p 76).**

"Big Piney Gets Its Wish . . ." is a little news vignette showing how the sparsely populated area of Upper Green River Valley in Wyoming managed to get central station service after the fire **(p 82).**

WASHINGTON ▶ **What's the status of the nation's nuclear power development program?** Hearings before the Joint Congressional Committee on Atomic Energy turns up conflicting answers. AEC Chairman Strauss believes U. S. progress adds up to an "impressive account of world leadership." But Tennessee's Sen Albert Gore calls the power reactor phase "completely inadequate." A middle course, and one certain to receive increasing attention in the months ahead, was suggested by AEC Commissioner Vance. He suggests one development program geared to satisfy domestic atomic power needs; another tailored to meet our international requirements **(p 78).**

DISTRIBUTION ▶ **Philadelphia Electric is getting amazing, though unexplained, lightning protection** on a 16-mile sub-transmission line through use of "deionisers." These gadgets,

taking the form of various shaped metal frames attached to insulators, are believed to direct and dissipate "vortical" lightning (bolts). Nobody seems to know just how they work, but the tests at Philadelphia indicate they cut lightning trippings from an average of seven down to one during their first test year. What's your explanation **(p 85)**?

SELLING ▶ **Heating the guest rooms at** Hinton's Motor Lodge, Irving, Texas, is a push-button job. Centrally controlled, the installation offers a maximum of safety and a minimum of waste. Reason is that it is all-electric. For Texas P & L, the Lodge offers 107 kw of connected heating and cooling load **(p 122)**.

McDermott tire recapping plant at Tulsa boasts electric buffers, recappers, dryer, conveyor, and air conditioner. The electric way pleases McDermott's customers and his employees **(p 110)** . . . Electric heating cables with rated load of 41.4 kw laid under a factory sidewalk at Erie, Pa., melts snow **(p 110)**.

MANAGEMENT ▶ **High interest rates may very well have a deleterious effect** on future common stock financing, reasons Charles Tatham, public utility analyst for Bache & Co. He doesn't anticipate that electric companies will have any trouble in obtaining bond or preferred stock money but feels the real impact of higher costs for these senior securities will be on the residual earnings for the common stock. It is up to management, Tatham writes, to develop evidence of what the necessary capital-attracting return is in such times as these—when interest rates have been rising sharply and the effect of this on the cost of common stock capital is as yet largely unknown **(p 88)**.

Village council of Sabina, Ohio, halts proposed sale of municipal power plant to Dayton P&L . . . New utility construction plans are announced . . . Arizona Public Service finds most of the recruits for its new electronic computing section right in its own ranks **(p 165)**.

PEOPLE ▶ **J. Ernest Doolittle is new vice president** in charge of commercial relations for Central Hudson G&E succeeding Harris E. Dexter who retires **(p 170)** . . . Bonneville Power Administration's Roger L. Conkling, director of budget and management, wins a Arthur J. Flemming award for outstanding government service . . . F. Gerald LeForge is promoted to superintendent of Central Illinois Public Service's Grant Tower Station **(p 172)**.

MANUFACTURERS ▶ **Allis-Chalmers reports new sales high of $547.4** million for 1956—gain of $12 million over 1955, but net income dipped to $20.3 million vs $24.8 million in 1955 . . . Westinghouse suffered $1.14 (per share) loss in first quarter of 1956, but net income snapped back to 38¢ in second quarter, 59¢ in third, and 98¢ in fourth quarter . . . New line of dual-voltage distribution transformers has been designed for economic use when a system voltage increase is planned . . . New compact, low-cost potential transformer has connected-in-series winding. Designed line-to-ground connection on 115 through 230 kv, the unit carries an ASA-rated 0.3 accuracy at standard burdens **(p 120)**.

NEW EQUIPMENT ▶ **Self-supporting lightning arresters,** designed primarily for large substations, are now on the market in ratings from 48 to 336 kv. They are said to need less mounting height and require no brackets or supporting structures for mounting on power transformers . . . Indoor, dustproof capacitors which cover bushings, fuses, terminals, and connections are available in single and multiple units. Individual units are rated 5, 7.5, and 15 kvar at 230 v and 10, 15, and 20 kvar at 460 or 575 v **(p 126)**.

ENGINEERING TRENDS

Solar furnaces will soon provide controlled temperatures to 6,000F with rises as rapid as 1,000F per sec, according to *Wall Street Journal's* report of the Solar Furnace Symposium at Phoenix, Ariz., January 21-2.

Dry chemicals can extinguish fires in the largest transformers in use today, according to tests by an eastern utility. Automatic control is considered entirely practical.

Fault currents will be held under one amp and immediate shutdown avoided by the ground-fault neutralizer planned for New England Power Co's new 160-Mva generator at Salem Harbor Station. Spaced configuration of the 27 cables from the generator to the main transformer in three 26-in. circular duct banks will provide current equalization.

Civil Defense's impact on utilities now includes their mobile radio. Kansas P&L Co has added Conelrad monitors to its statewide radio system and will silence it during alerts. Silence can be broken in emergency by mobile units using only truck numbers and base stations omitting call letters and locations.

Interrupting duty on over-dutied breakers can be minimized by delaying reclosures, restricting the number of reclosures on severe faults, cutting the duty with sequential tripping, and block tripping for severe faults.

Water at 180F circulated through generator cooling coils while the machine is rolled on steam is under investigation by Consolidated Edison Co for safe pre-warming of large turbine generators.

Radio interference has gained new importance with Signal Corps Gen E. F. Cook's warning that widespread civilian use of electrical and electronic equipment is impairing America's defense systems. Need for interference-free operation of a new radio-astronomy observatory has driven National Science Foundation to a bowl-shaped valley surrounded by forests in the West Virginia mountains.

FROM EDITORS IN THE FIELD

Tacoma City Light's six cables over the Narrows have been painted with asphalt using circular groups of brushes arranged to cover the cable in a single application as the work platform moves along.

Reclosers serve as feeder breakers in distribution substations where fault duty is within their capability. Adding closing solenoids, shunt trip coils, and auxiliary switches gives an Ohio utility manual control from the station switchboard.

Better service, improved load factor, and higher rate of return have been attained by Kansas City Power & Light Co by applying a signal actuated by distribution transformer loading to cut off water heaters when load nears peak.

L-M Round-Wound Transformers have natural oil passages between cruciform core and round coil **(1)** to help dissipate heat from the coils more rapidly. In addition, ducts provided by spacers placed between windings **(2)** and between layers in most sizes provide additional oil circulation.

Why More Customers Are Selecting L-M Round-Wound® Transformers

Many factors enter into transformer selection. Here are some of the reasons for the great increase in customer preference for L-M's obround-shape Round-Wound transformers.

Balanced Performance: The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

Higher Uniform-Impulse Level: Round coils are wound into shape. Therefore, insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

Higher Short-Circuit Strength: Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

Higher Short-Time Overload Capacity: Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

Additional Capacity on Pole: L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces bending moment on the pole and crossarms, and thus greatly increases potential capacity of existing transformer structures.

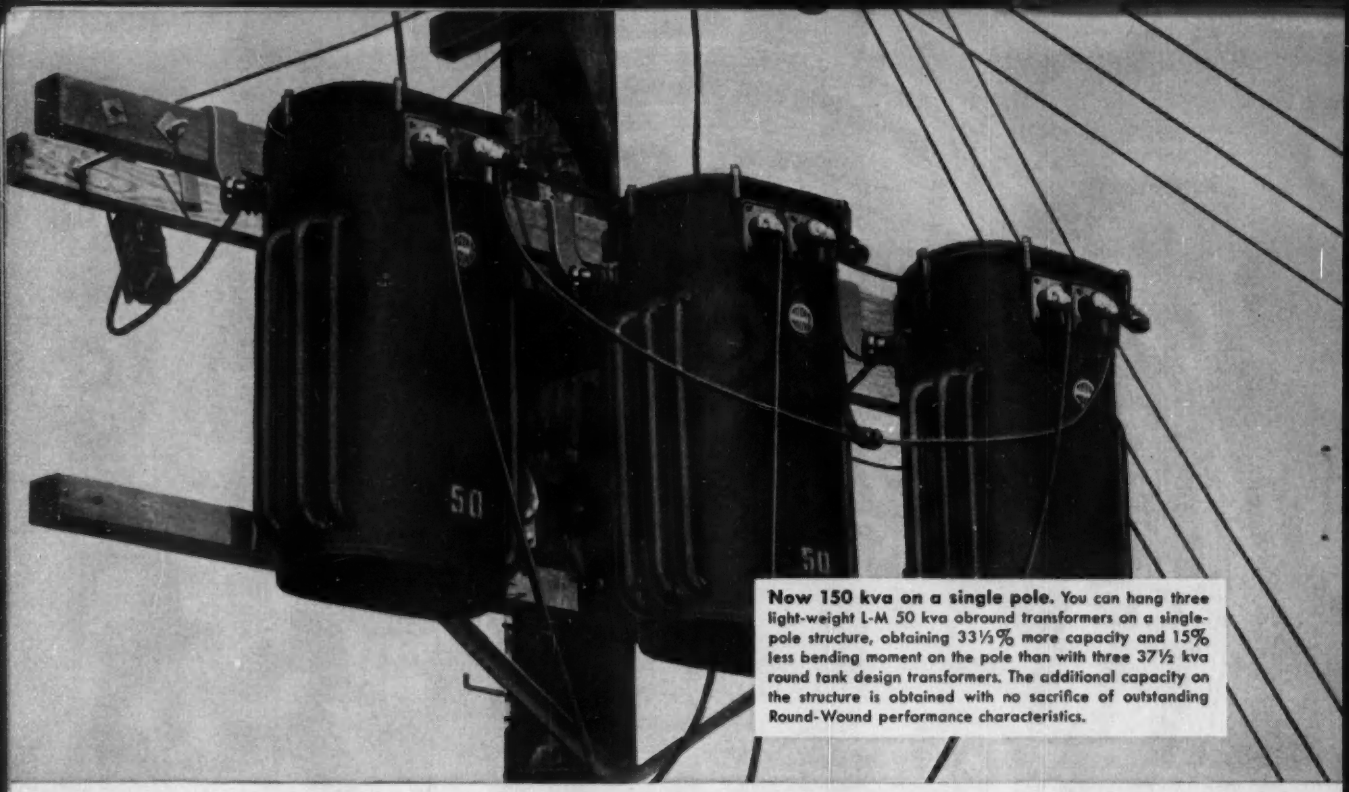
Get Complete Information

Ask your L-M Field Engineer for complete information and bulletins on L-M's Round-Wound Transformers. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

286-R

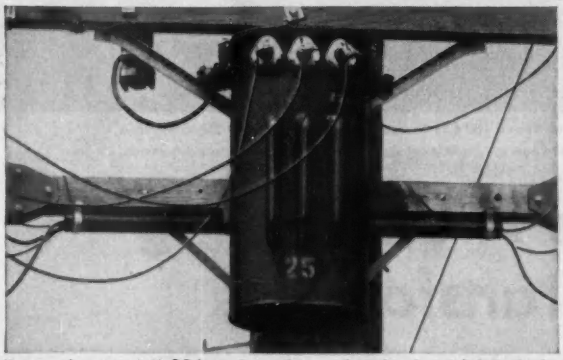
LM **LINE MATERIAL**

McGRAW-EDISON COMPANY

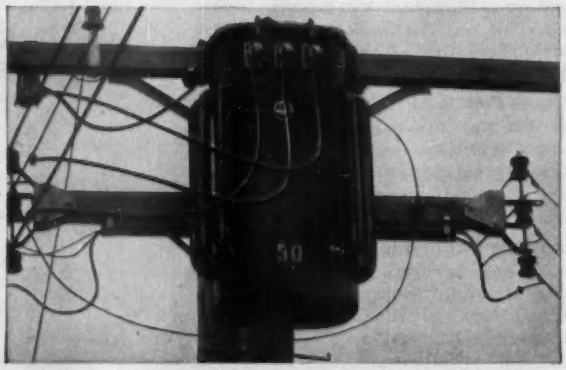


Now 150 kva on a single pole. You can hang three light-weight L-M 50 kva obround transformers on a single-pole structure, obtaining 33⅓% more capacity and 15% less bending moment on the pole than with three 37½ kva round tank design transformers. The additional capacity on the structure is obtained with no sacrifice of outstanding Round-Wound performance characteristics.

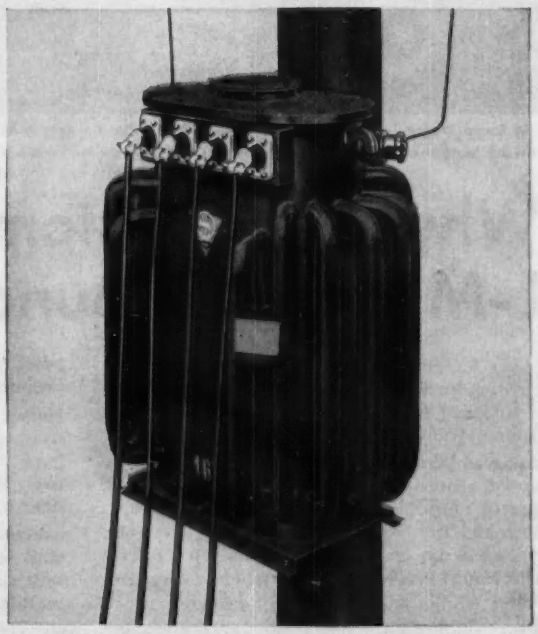
How L-M's Obround Transformer Design



You can hang an L-M 25 kva obround on a class 4 pole, and thus obtain 66⅔% increase in capacity with very little increase in bending moment over a 15 kva round tank design transformer.



You can pole-mount an L-M 50 kva obround transformer and thus obtain 33⅓% more capacity and 15% less bending moment on the pole than with a 37½ kva round tank design transformer.



The light-weight L-M obround 167 kva transformer can be single-pole mounted. In addition to being exceptionally quiet, the overload capacity, regulation, and other Round-Wound characteristics have been fully maintained in this new design.

LINE MATERIAL

McGRAW-EDISON COMPANY

Now 500 kva on a two-pole structure. You can hang three light-weight L-M 167 kva obround transformers on a two-pole structure, obtaining 66⅔% more capacity and less bending moment on the pole than with three 100 kva older-design transformers.

Cuts Your Construction Costs

Now you can hang larger-capacity transformers on a pole. Transformer is smaller, lighter, and has shorter moment arm; retains all outstanding Round-Wound® performance characteristics.

By **ALVIN B. COYLE**
Product Manager
Transformers
Line Material Company

The potential capacity of all your transformer structures is greatly increased when you specify Line Material's lighter, smaller, obround transformer. You can now hang three 50 kva transformers on a single-pole structure instead of three 37½'s; or three 167 kva transformers on a two-pole structure, with less bending moment than with three 100 kva older-design transformers.

Less Weight

The new obround design has a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Additional cooling tubes compensate for the reduced tank size and provide adequate cooling surface. Transfer of heat from the copper to outside air is faster and more efficient because of reduced mass.

Shorter Moment Arm

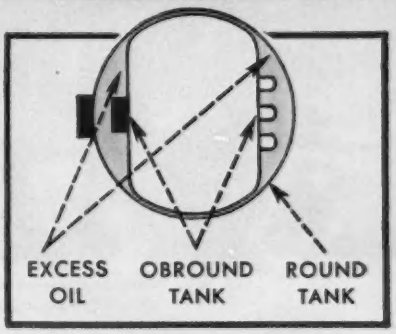
L-M's obround design brings the center of gravity closer to the pole, which reduces the moment arm distance from the pole. The combination of less weight and shorter moment arm distance substantially decreases the total bending moment on the pole and crossarms, and thus greatly increases the potential capacity of all your transformer structures.

Round-Wound Performance

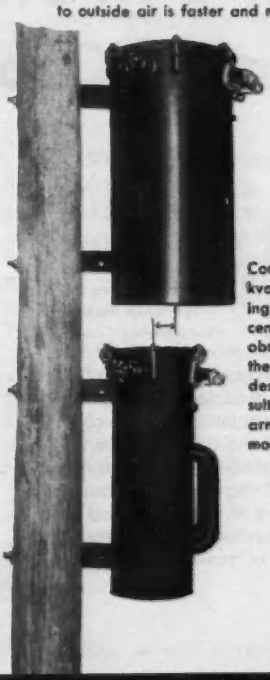
The additional capacity is accomplished without changing L-M's outstanding Round-Wound performance characteristics. These characteristics include low exciting current, low noise level, high impulse strength, high short-circuit strength, high short-time overload capacity and many others.

Get Details on L-M's Obround Transformer

Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and L-M's exclusive Round-Wound design. Or write Line Material Company, Transformer Division, Zanesville, Ohio.



L-M's obround design has less transformer oil. Additional cooling tubes provide adequate cooling. Transfer of heat from the copper to outside air is faster and more efficient.

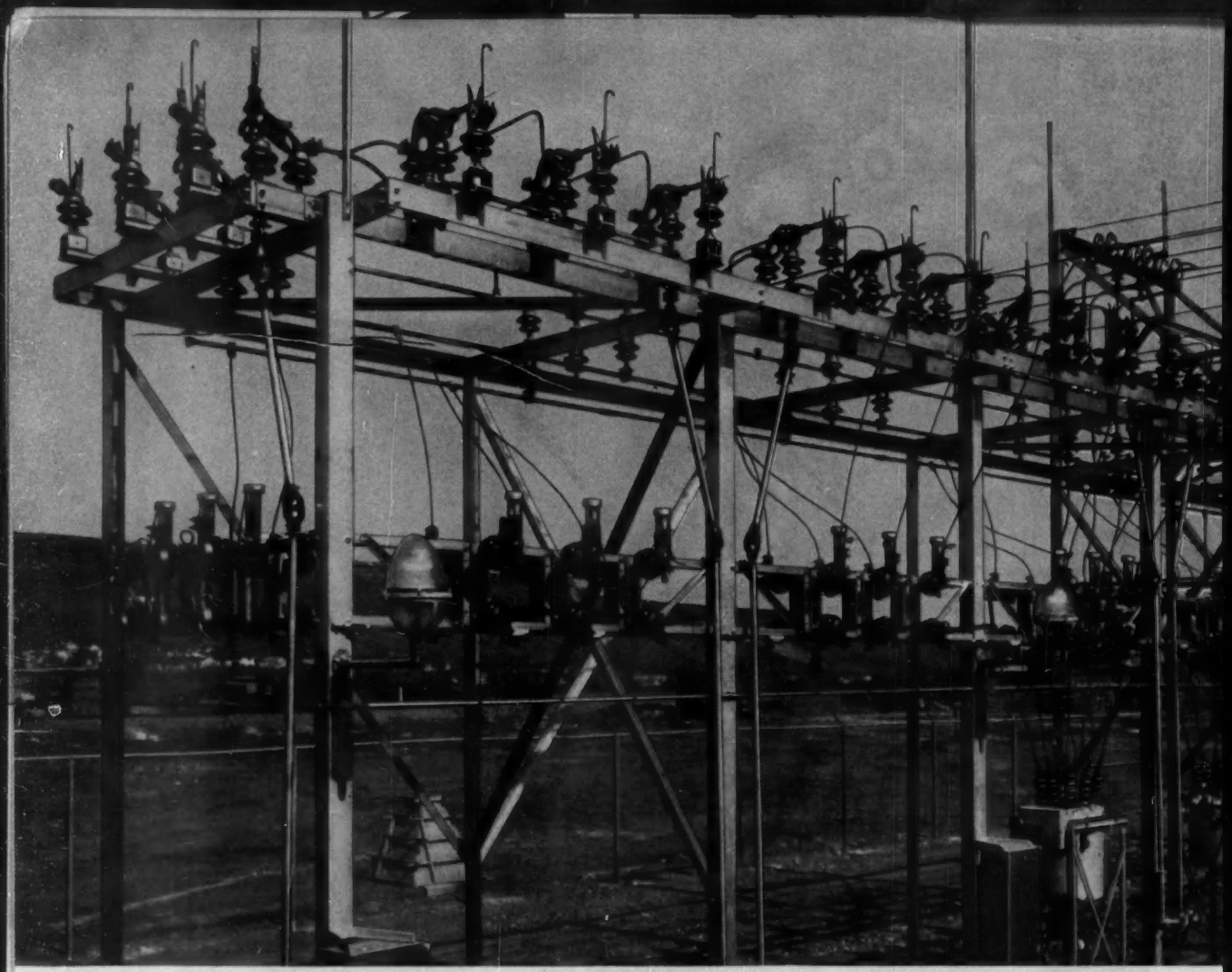


Comparison of two 25 kva transformers, showing how much closer the center of gravity of the obround design is to the pole than the round design, above. The result is shorter moment arm and less bending moment on the pole.

Transformers

252-R

Silicone Cord Ring



Nine L-M power switches and 20 hook switches at the 13.8 kv 20,000 kva switching center of a Northwest utility. L-M also furnished other equipment and apparatus.

How L-M Switch Design Insures High Thermal Capacity, Positive Operation

High-pressure silver-to-silver contacts provide cool operation; powerful lever advantage to open and close switch insures easy operation at all times.

by **HARVEY BAERWALD**
Sales Application Engineer
Power Switching And
Substation Section
Line Material Company

Line Material has designed high thermal capacity and trouble-free operation into its line of power switches. Powerful lever advantage of the operating mechanism and silicone-grease-lubricated and sealed bearings at all moving joints insure positive operation to open or closed switch position regardless of ice, corrosion, or long periods of non-operation.

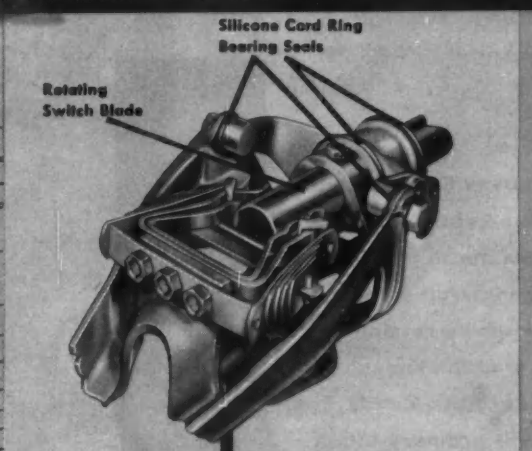
Tremendous Lever Advantage

Operating mechanism provides a tremendous lever advantage by utilizing unique rotating switch blade design. Before the blade even begins to rise in the contacts, it is rotated 26 degrees—the full force is applied to blade rotation, breaking any possible condition of ice, corrosion, or contamination.

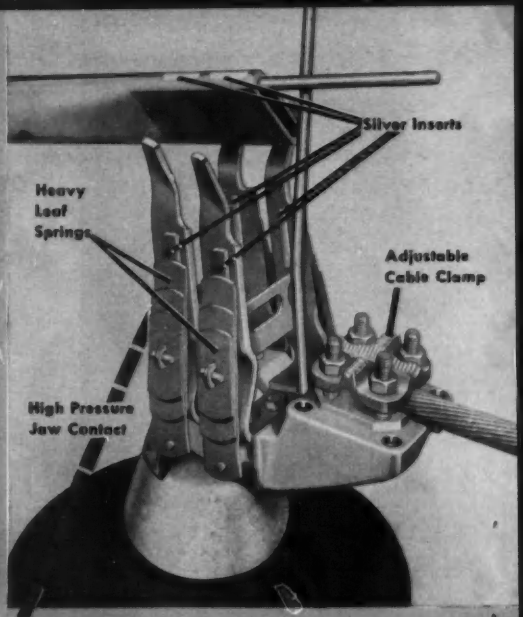
Smooth, Easy Operation

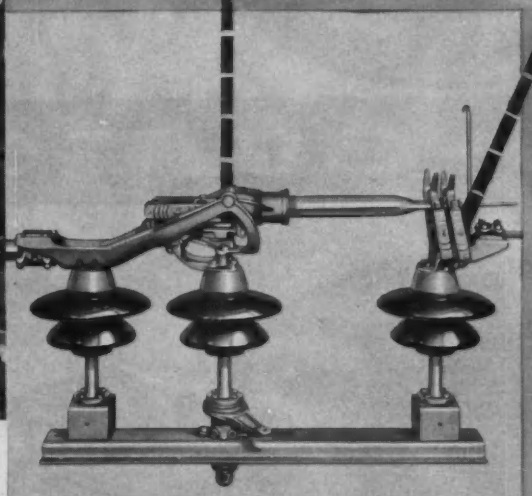
The hinge operating mechanism also provides smooth, positive blade rotation and blade rise. All bearings and all moving joints on the switch and on the interphase mechanism assembly are silicone-grease-lubricated for life and positively sealed with silicone cord rings.

LINE MATERIAL
McGRAW-EDISON COMPANY

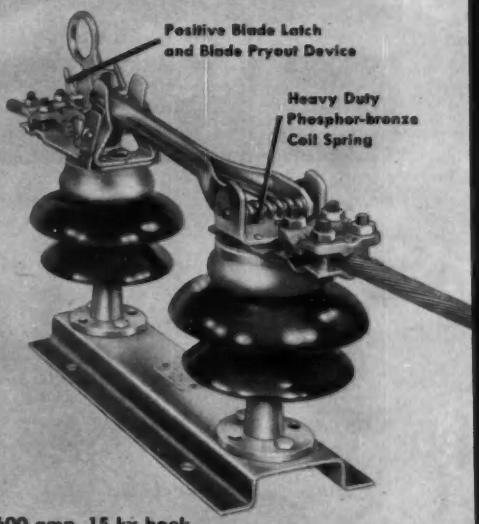


Hinge Mechanism showing
L-M outstanding features





1200 amp. 34.5 kv vertical break
type PV switch



600 amp. 15 kv hook
stick operated Disconnect Switch

Grease can't get out; water, dust, or dirt can't get in to freeze or start corrosion.

On 69 kv ratings and above, a counterbalance spring is provided to counteract blade weight. It is a self-centering, double coil, floating spring which is positive acting and trouble-free.

High Thermal Capacity

L-M's power switching equipment provides extremely high thermal capacity for both continuous current and short-time high current carrying applications.

Silver inlays in both blade and contact shoes insure high current-carrying capacity at both jaw and hinge contacts. During the closing operations, blade rotation provides a wiping action assuring clean silver-to-silver contact surfaces.

The jaw contact assembly has large copper shoes which exert 175 pounds pressure on the silver-to-silver contacts. This high pressure is maintained by heavy leaf springs to provide uniformly high thermal capacity.

L-M's power switches also have fewer current interchange points because the terminal connectors are designed as an integral part of the contact adapter.

Simple Construction

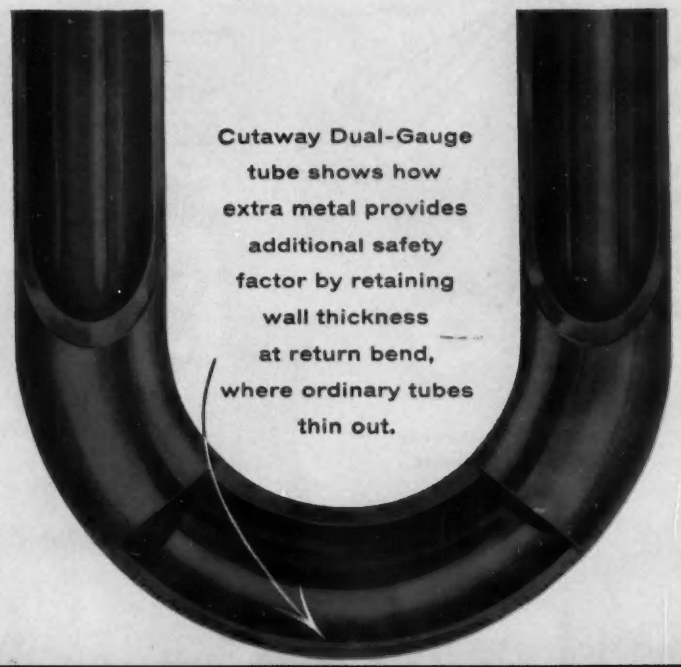
Turnbuckle interphase adjustments make L-M group-operated switches easy to install. Flexible interphase mechanism assures positive operation without periodic maintenance, even after the structure has become severely distorted.

Get Complete Information

Ask your L-M Field Engineer for information and bulletins on L-M's Power Switching Equipment. Or write Line Material Company, Milwaukee 1, Wis.

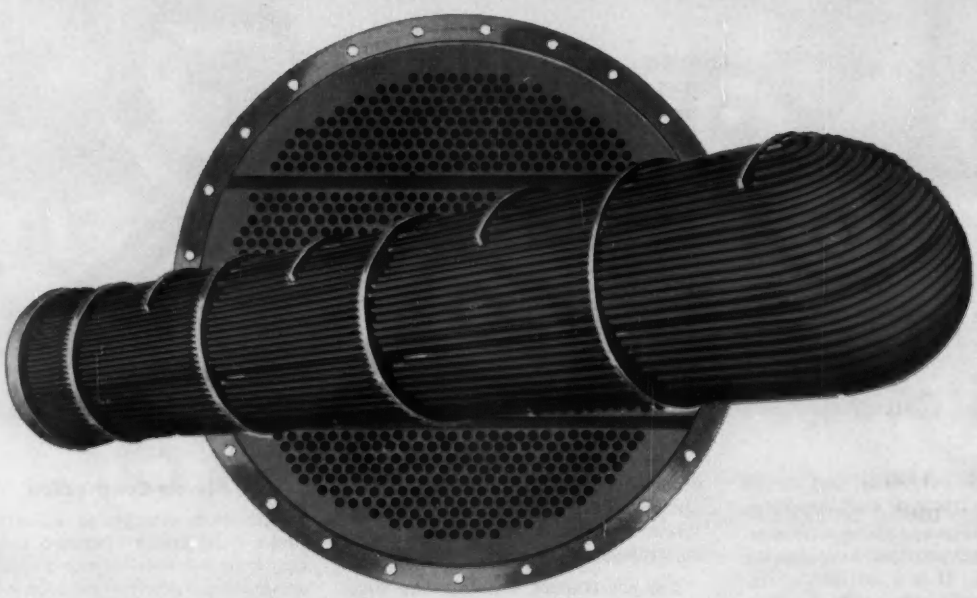
Power Switching Equipment

266-R



Specify

DUAL-GAUGE



First for Lasting Quality—from Mine to Market!

To keep tubes uniformly strong
in condensers, feed water heaters,
heat exchangers and similar equipment...

PHELPS DODGE

TUBING!

- Provides heavier wall thickness:
  - **a.** At one or more points in tube length to compensate for thinning on outer portions of return bends.
  - **b.** At points of support.
  - **c.** At tube ends to meet special requirements.
- Produced in all standard sizes or manufactured to the particular design requirements of individual customers.
- Available in Cupro-Nickel, Red Brass, Aluminum Brass, Admiralty metal and Muntz metal.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

Bonneville depends on

Microwave FOR COMMUNICATIONS TELEMETERING REMOTE CONTROL and VHF CONTROL

a 600-mile microwave system requiring greatest reliability

There's no icing of these microwave dishes—*not even in the snowbound Northwest*—thanks to a newly developed Philco antenna cover, Thermo-Microdome! Complete de-icing . . . a *must* for reliability in any communications system . . . but only one of many features, including diversity, in the microwave installation of the Bonneville Power Administration.

Here are a few of Bonneville's microwave facilities: An extensive telemetering system in Portland, Oregon, control center for the Federal Columbia River generating and transmission system, gives instantaneous readings of voltage, frequency and power produced by five distant dams. Sixteen telemetering channels are carried by a single voice channel for 28 hops—one over 60 miles long. Every station is equipped for ten automatic functions including fault reporting, standby-switching and equipment "status check"!

Philco offers a "complete microwave package": Every item of equipment you may need; experienced system planning; installation and service after the sale. Write Department EW for full details.

Bonneville's custom-built Augspurger microwave station. Durable shelters to house microwave and multiplex equipment, as well as towers, antennas, and reflectors, are available in the Philco product line.

Beside utilities such as the Bonneville Power Administration, Philco has installed extensive systems for leading pipelines, turnpikes, railroads, telephone companies and governmental agencies.

PHILCO—*Pioneer and World Leader in Microwave*

PHILCO CORPORATION

GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44 PENNSYLVANIA

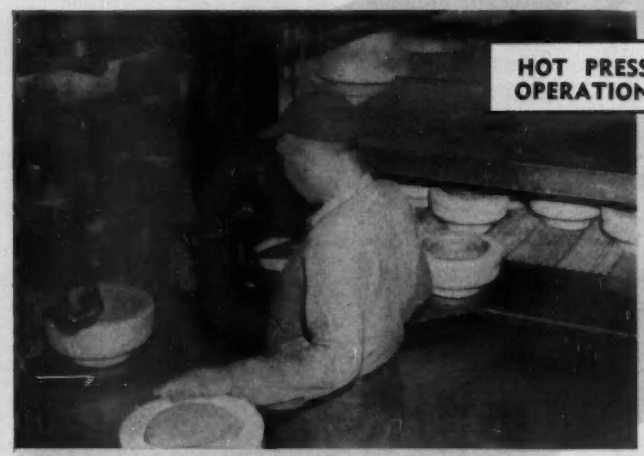
PHILCO Trade for QUALITY Mark Reg. GI

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

what's goin' on?

Mr. Power Company Engineer—
how'd you like to come along and see some of the "high spots" in the making of a 10" suspension insulator, see for yourself why **PORCELAIN PRODUCTS INSULATORS** are products of **RECOGNIZED RELIABILITY.**

Mr. P.C.E., all incoming raw materials and production mixes undergo series of batch control tests to see that they meet our particular specifications. To assure homogeneity of porcelain an intimate mixture of the raw materials is essential.



HOT PRESS OPERATION

Our first "high spot", beyond the actual mixing of the raw materials in the manufacture of an insulator is the "hot press" operation. The clay (pug or blank) from the pug mill, where it has been kneaded into a solid mass and absorbed air removed by vacuum, is put in a mold and then placed in the Hydraulic Press under a heated rotating male die that forms the skirted section or underside of the insulator — the mold partially forms the top side. The mold and the hot pressed body is sent through a mold release and conditioning dryer to effect mold release. After release from the mold the ware passes through the conditioning dryer which removes moisture content but only to the degree that the precise amount retained makes the ware ideal for trimming.

TRIMMING

The ware is now placed on revolving spindles and the top surface, or surface formed by the mold, is trimmed and smoothed to its final shape. It then passes through long continuous dryers which further reduces moisture content to approximately 1%.

GLAZING

And here's our next high spot — the automatic **GLAZING** operation (accurately controls glaze thickness). This consists of coating all, or certain parts of the ware, with a glaze (glass like) which fuses to the porcelain body during its firing cycle.

This glaze has to "fit" the clay body. By "fit" we mean that the glaze has to have the property of expanding and contracting thermally with that of the underlying clay body. Any marked variation of the glaze "fit" affects the mechanical strength of the insulator.

Also, at this time, "sand bands" (specially sized porcelain grains) are applied to the areas that will form gripping surfaces for the individual parts in final assembly.

After firing the porcelain shells are given a thorough visual inspection and then placed on a continuously operating electrical testing machine, receiving a 3 to 5 second flashover test of high frequency (200 KC) voltage followed by a full five minute flashover test of 60 cycle voltage. This rigid procedure of **INSPECTION** and **TESTING** at this stage is done to assure the highest quality porcelain shell possible prior to insulator assembly.

INSPECTION & TESTING

ASSEMBLY

Our next "high spot"—the **ASSEMBLY OPERATION.** Here, the cap and the stud (or pin) are cemented to the porcelain shell. Neat Portland Insulator Grade Cement (water & cement) mix is used. Note the compound on the stud, head of the shell and inside of the cap — also the Coprene washer inserted in the bottom of the pin (stud) hole.

These assemblies are now steamed (cured) for 48 hours giving about 90% of ultimate cement strength.

The insulators are now cleaned and mechanically "pull tested" to 50% of rated value.

FINAL TESTING

And this is our last "high spot" Mr. P.C.E. — **the final Electrical Test.** Here each assembled unit is given a 3-5 second high frequency (200 KC) voltage and a 5 minute flashover test of 60 cycle voltage.

After this it's final visual inspection and — on to the packing tables.

Well, Mr. P.C.E., it's been a quick trip and we've only been able to hit a few of the "high spots", but you've seen for yourself the rigid system of quality control in our operations — we always welcome P.C.E. visits to our plant.

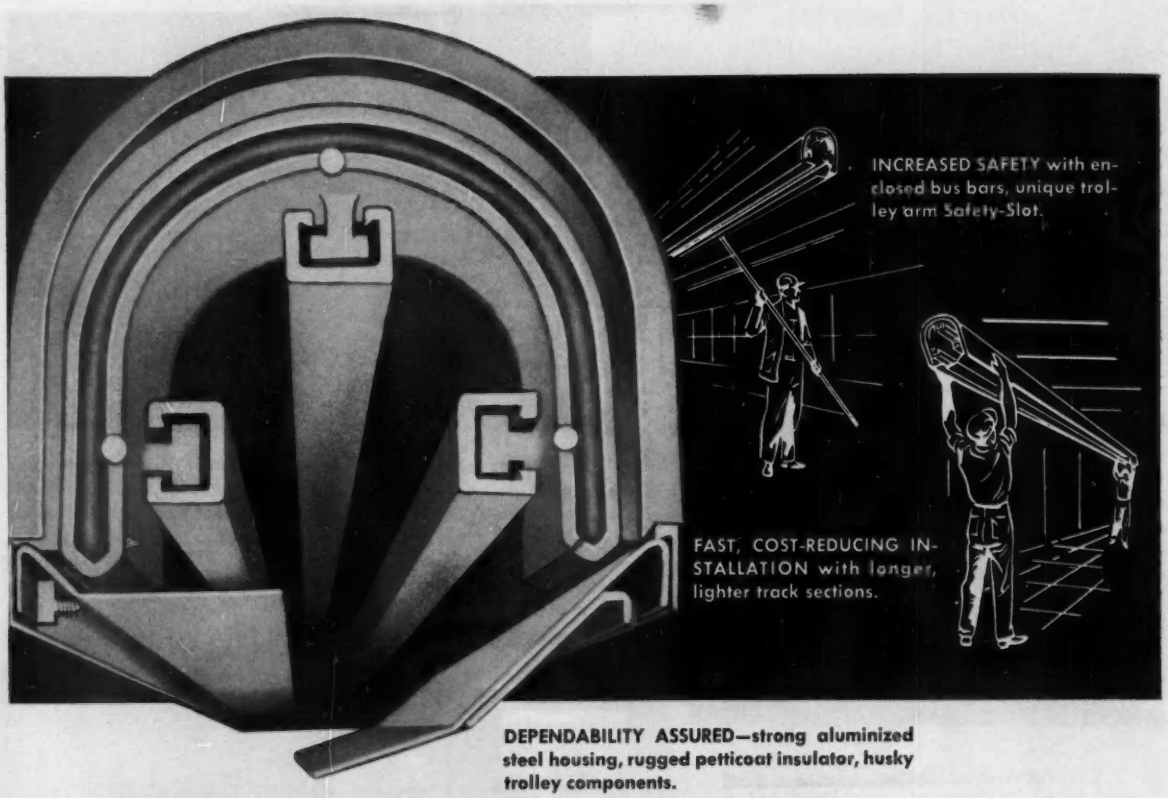
PP INC.

EEI-NEMA CLASS 52-3 PP 66255

"You've sold me! And I certainly see now why **PORCELAIN PRODUCTS INSULATORS** deserve their widespread acceptance as products of RECOGNIZED

Porcelain Products, Inc.

High Voltage Division — **Parkersburg, W. Va.**


INCREASED SAFETY with enclosed bus bars, unique trolley arm Safety-Slot.
FAST, COST-REDUCING INSTALLATION with longer, lighter track sections.

DEPENDABILITY ASSURED—strong aluminized steel housing, rugged petticoat insulator, husky trolley components.

New *LEC-TROL-FEED* System

for fast-action installation—safety-first power

This new, preassembled LEC-TROL-FEED conductor system gives you outstanding advantages for supplying electric power to cranes, hoists, welding units and other straight-runway equipment.

LEC-TROL-FEED Systems are installed faster and at lower cost than ever before. All units are preassembled in standard 30 ft. rigid-track sections. That means fewer joints, fewer hangers. Expansion sections are needed only at building joints. No extra rain shields needed for outdoor applications.

You gain maximum safety with LEC-TROL-FEED Systems because current carrying bus bars are almost completely enclosed—minimizing danger from contact with current-carrying bus. Trolley Safety-Slot covers are removable—parts easily accessible. Rugged trolley—can be dropped out every 30 feet.

Additional features include compactness for close vertical stacking, maximum ruggedness, maximum leakage distances, proved aluminum bus bars. Track power capacity 300 amperes, AC or DC; trolley ratings up to 300 amperes.

For complete information,
write or ask for LEC-TROL-FEED Bulletin.
Electric Service Works,
Delta-Star Electric Division,
H. K. Porter Company, Inc.,
Philadelphia 32, Pa.

HKP

ELECTRIC SERVICE WORKS
DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Conners Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Rubber, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings

for easy handling

AWG 14-6 in cartons
AWG 4-2 in wrapped coils
AWG 1-1,000,000CM on reels

Southwire

BUILDING WIRE

type TW
full range of sizes
standard colors
UL approved

Southwire type TW building wire is conveniently packaged for easy warehousing and installation—Underwriter Laboratory approved and suitable for general use in conduit, raceways or on insulators. All Southwire TW is oil, moisture and flame resistant and approved for wet location installations. Smaller sizes are prelubricated for ease of pulling in conduit.

Order Southwire TW and get Southwire service automatically—rapid delivery via our own trucks from the most complete mill warehouse stock in the South.

SOUTHWIRE PRODUCTS

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene Weatherproof Copper, Aluminum and Triplex
- Polyethylene Weatherproof Copper, Aluminum and Triplex
- Southwire Vinyl Weatherproof Copper, Aluminum and Triplex
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
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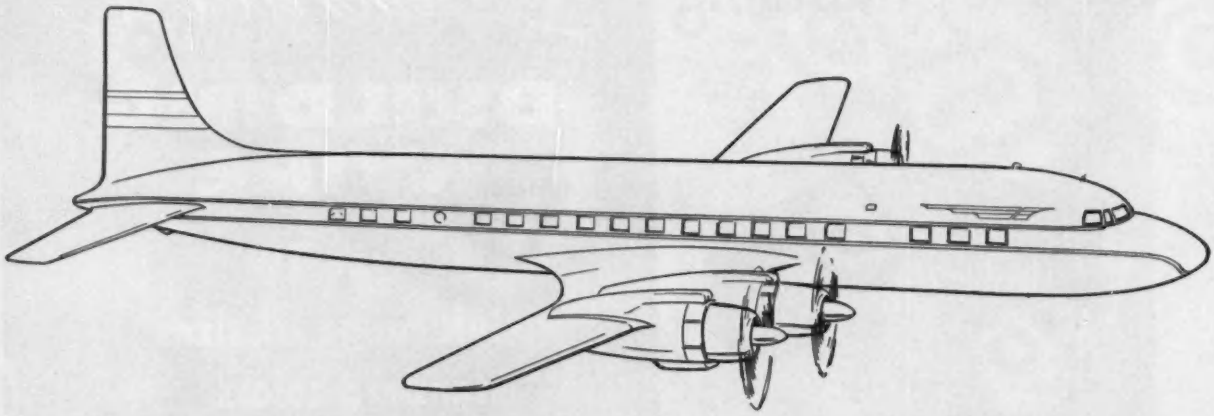
"SOUTHWIRE MEANS SERVICE"

Southwire Company

TErrace 2-6311 CARROLLTON, GEORGIA



FORGED PROPELLERS *keep airplanes in the air . . .*

FORGED SUSPENSION CLAMPS *keep transmission lines up there too!*

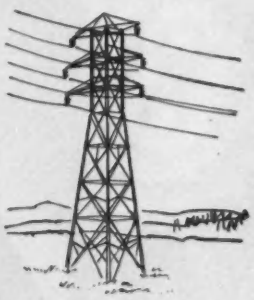
ALL COMMERCIAL AIRCRAFT . . .

now in service have forged aluminum propellers. Because they are drop forged, the blades have maximum strength with minimum sectional thickness and weights. Forged propellers with their superior physical properties withstand the centrifugal forces, fatigue strains and impact shocks imposed by present day aircraft.

DROP FORGING makes the difference in airplane propellers and Suspension Clamps. BTC Drop Forged Suspension Clamps, for example, develop uniformly high strength—more than adequate for field service. Heavy sections or reinforcing ribs are not needed for strength or to prevent collapse or breakage under U-Bolt Clamping pressure. Thus, undesirable weight is eliminated without sacrificing strength.

The BTC Clamp's superior strength guards against failure under severe loading, while its greater hardness prevents excessive wear on connecting surfaces. No bore size allowance for manufacturing variations is necessary due to the close dimensional fidelity of the die-forged parts.

BTC Suspension Clamps are recommended for application on all transmission line conductors in general use. Choose the right Clamp for your conductor from BTC's complete line of Drop-Forged Steel or Aluminum Suspension Clamps.



6200A SERIES

Steel Suspension Clamps. Drop-forged steel, hot-dip galvanized, suitable for all conductors. All clamps may be supplied with Aluminum or Copper Liners as required.

9500 SERIES

M.P.L. (Minimum Power Loss) Aluminum Suspension Clamps. Drop-forged, heat-treated Aluminum Alloy Clamps for A.C.S.R. and All-Aluminum Conductors.

Specify

BTC

DROP-FORGED Hi-Line Hardware

. . . from your Insulator Manufacturer

The BREWER-TITCHENER CORPORATION, Cortland, N. Y.

Your Westinghouse representative can prove . . .

20% INCREASED OVERLOAD CAPACITY

in all new Westinghouse distribution transformers *without sacrifice of service life!* The evidence is several thousand Westinghouse transformers with increased breaker settings put on Union Electric's lines, many since 1954, without a single burnout.

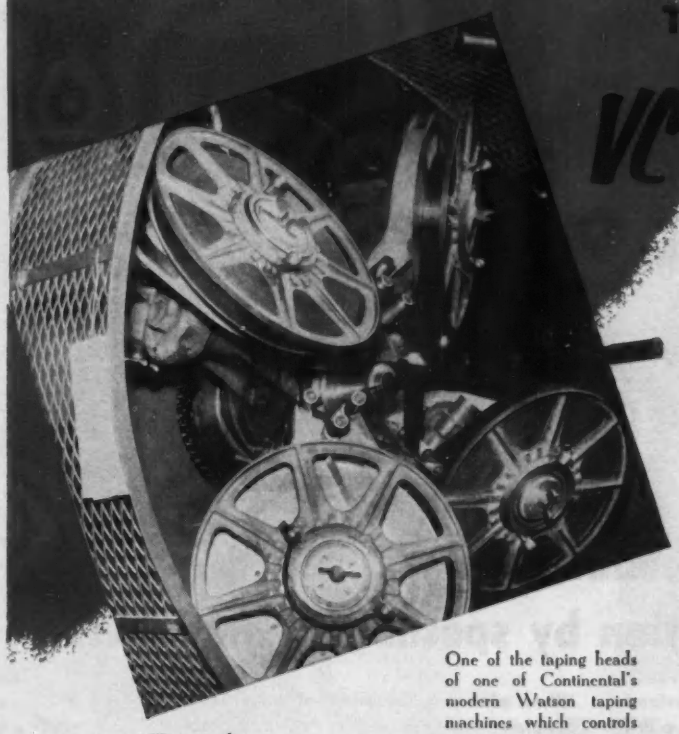
YOU CAN BE SURE...IF IT'S

Westinghouse

W. R. McMillan, Supt. Distribution, Union Electric Co., one of three utilities who joined Westinghouse for this major development, with Cooper Slay, St. Louis Westinghouse representative. "Higher Westinghouse transformer breaker settings have meant a decided decrease in breaker trip-outs with no loss of transformer life" . . . Mr. McMillan.

J-70788

Continental Uses NATVAR CABLE TAPE TO INSULATE VC Power Cable



One of the taping heads of one of Continental's modern Watson taping machines which controls tension and lay. Operators like Natvar VC Cable Tape because it is easy to apply and always the same. Complete test report is furnished with each shipment.

Continental Wire Corporation, with plants at Wallingford, Conn. and York, Pa., manufactures wires, cables, and cords—in sizes up to 2,000 mcm, and for operation in ambients to 400°F and above. They place particular emphasis on *quality* and *service*.

They believe that *quality* is the result of research and development, good materials, modern equipment operated by experienced manpower, and relentless testing and inspection—and that *service* is based on understanding of customers' problems. And so does Natvar, which may well be one of the reasons they work so well together.

If you are looking for flexible insulating materials with exceptional physical and electrical properties, plus prompt, competent service, it will pay you to get in touch with Natvar.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet, tape, tubing and sleeving
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

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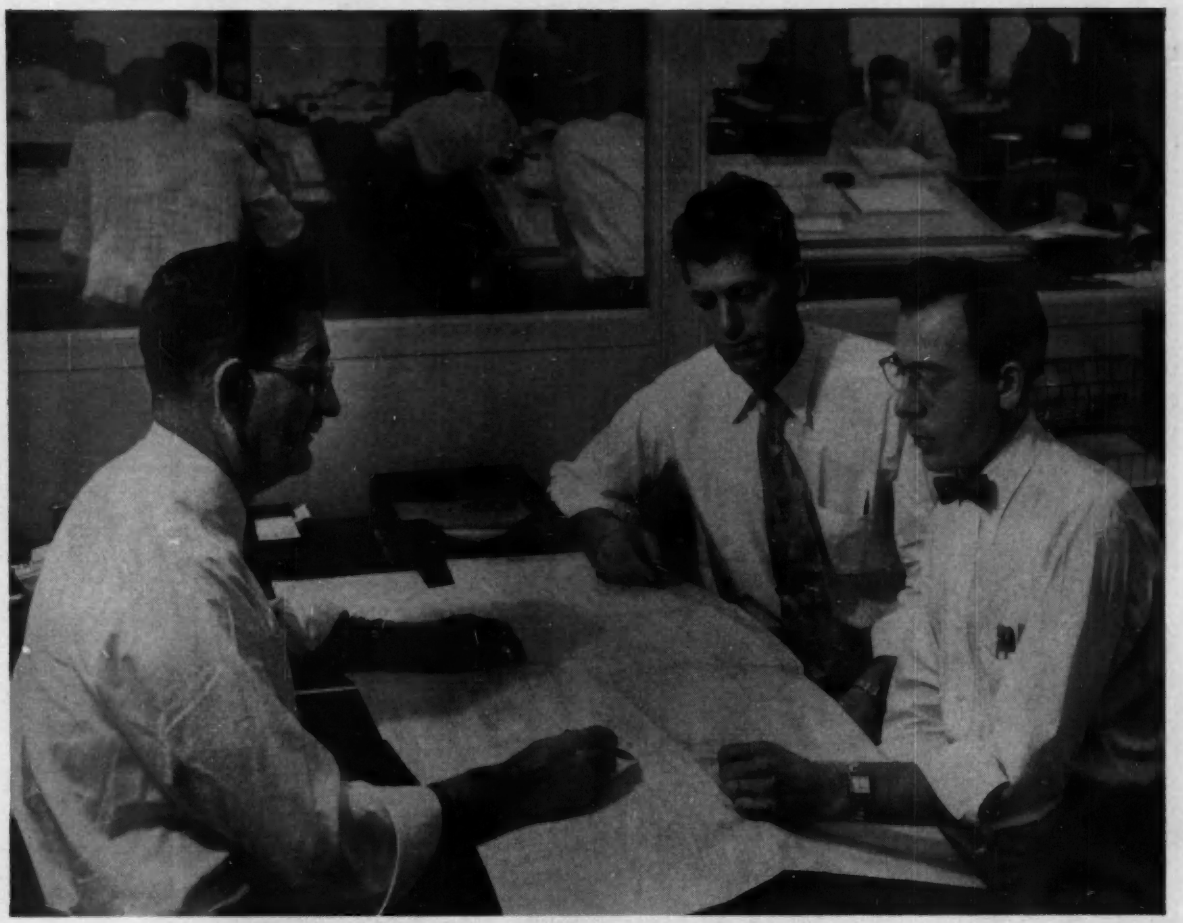
CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

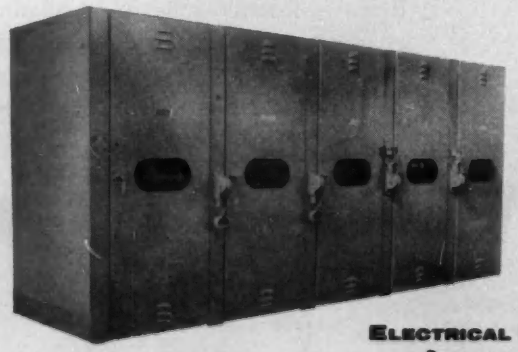
J-70788



Special switching problems need personal attention by specialized engineers

At 3E your inquiry or order receives *personalized, specialized* engineering attention. The typical scene above points up this fact as plans for a switching center get immediate attention from C. A. Koerner, Vice President and Chief Engineer. Engineers Ray Rueffer and Gene Phillips are specialists in switching center design. Their combined know-how coupled with the 3E Company's 45 years of experience in handling switching problems is focused on this customer's particular requirements.

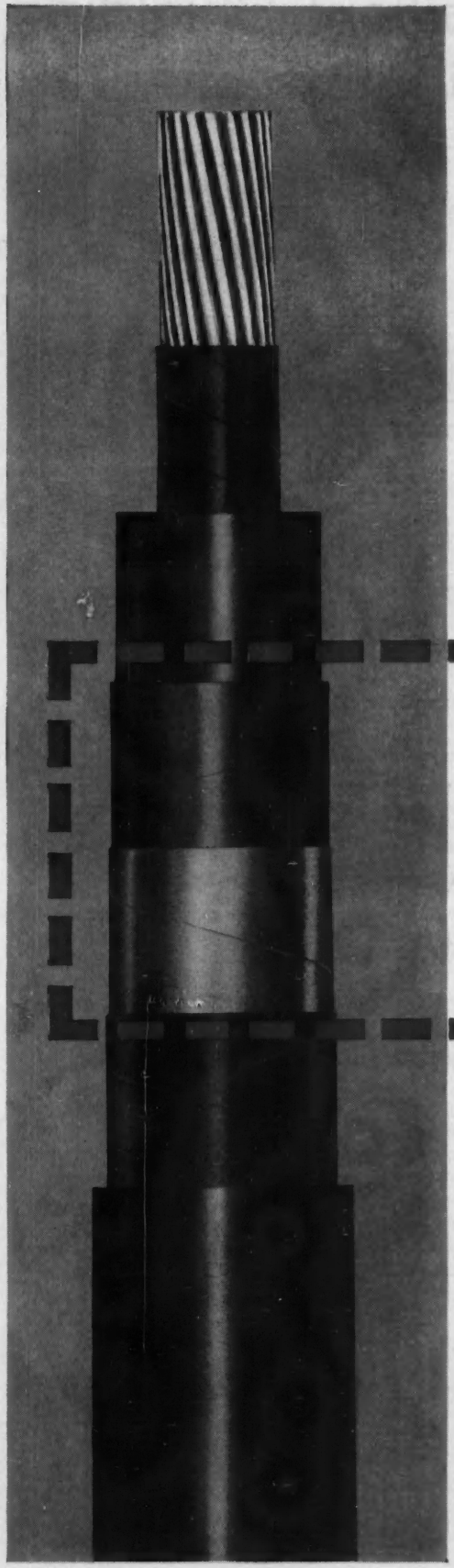
When planning for unusual conditions ... limited space ... plants with dusty or corrosive atmosphere ... or where you need economy today plus allowance for tomorrow's expansion ... *see 3E.* Our staff of qualified engineers is experienced in handling the unusual ... with a fine record in designing for economy without loss of efficiency or safety. Their facility with standard 3E components designed for maximum flexibility is an asset that is beneficial to our customers.



3E Auto Speed load interrupters together with 3E know-how made this 5 bay switching center safe, sure and economical.

3E

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois
Representatives in principal cities — in Canada by Powerlite Devices, Ltd.



A new advancement in high-voltage cable engineering

ANACONDA announces Resilient Shielding*

RS

RESILIENT SHIELDING

Resilient Shielding — developed by Anaconda — retains the continuity and effectiveness of the shielding system during expansion and contraction of cable during load cycles. Result: longer cable life . . . at no extra cost to you.

*U.S. Patent No. 2754352

(Read following pages for full details)

New Anaconda Resilient Shielding ... maintains integrity

with conventional shielding

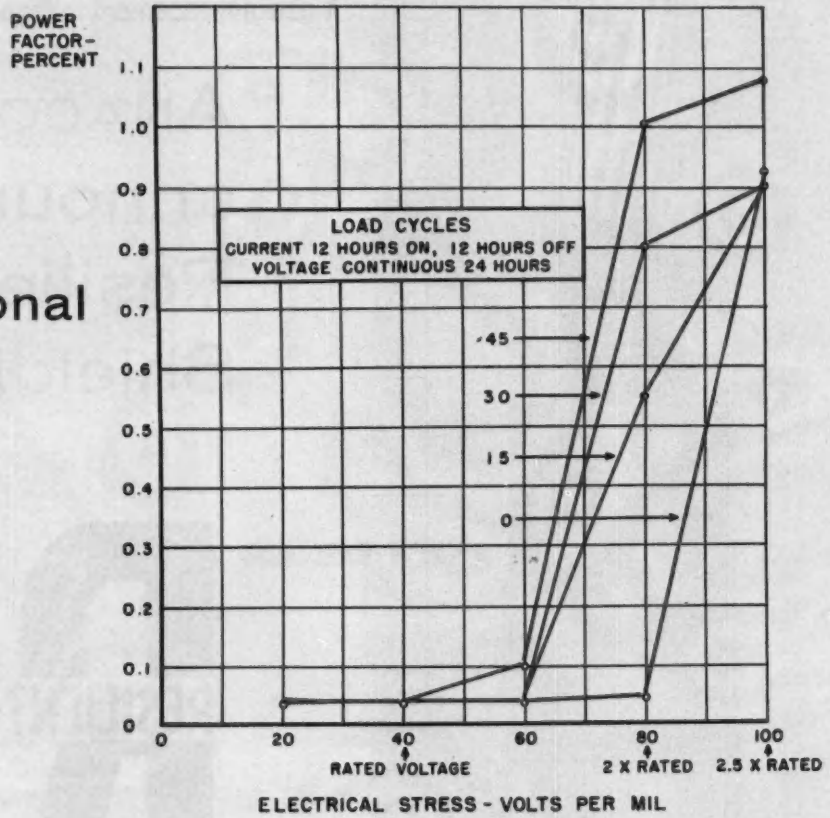


Chart of a load-cycle test. Power factor increase, an indication of insulation deterioration, begins with early load cycles, and continues through 45. Failure occurred during the 47th cycle.

The Problem: Polyethylene's high dielectric strength and resistance to moisture make it an excellent insulation. But another characteristic is its unusually high expansion under the heat of normal load. In shielded cable, the resultant expansion (and contraction) is great enough to destroy the continuity and effectiveness of the shielding tape. And early deterioration may result.

For example, this effect is illustrated above on a 15-kv polyethylene-insulated cable, described as: 1/c, 350 Mcm, 14/64 inch insulation, shielding, cable tape over the shielding, PVC jacket over-all.

The left-hand chart shows the results of severe cyclic-aging tests on cable with conventional shielding, with voltage and temperature increased as the test proceeded.

Power factor of the insulation is an indication of the condition of the insulation under temperature and voltage stress. If the insulation stays undisturbed, power factor continues low.

In this case, with conventional shielding, power factor rose with repeated load cycles, indicating disruption of the shielding. Early failure can result — and did, during the 47th cycle.

GIVES YOU EXTRA PROTECTION AT NO EXTRA COST

means longer cable life of the insulation

with new Anaconda Resilient Shielding

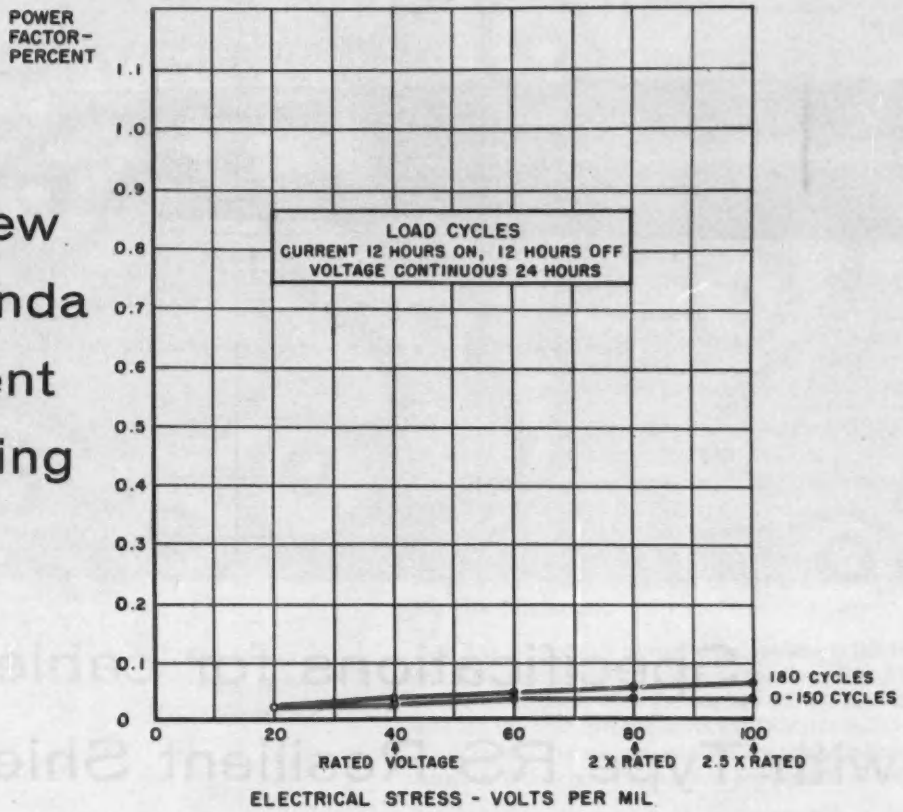


Chart of a load-cycle test. With Anaconda Type RS Resilient Shielding, power factor remains practically unchanged for 150 load cycles, and shows only a small increase up to 180.

The Solution: To solve problems of disrupted shielding, Anaconda engineers developed the use of a semiconducting *resilient* tape under the copper shielding tape. This resilient tape contracts and expands with the insulation – prevents damage to the shielding tape. No voids develop – cable life is improved.

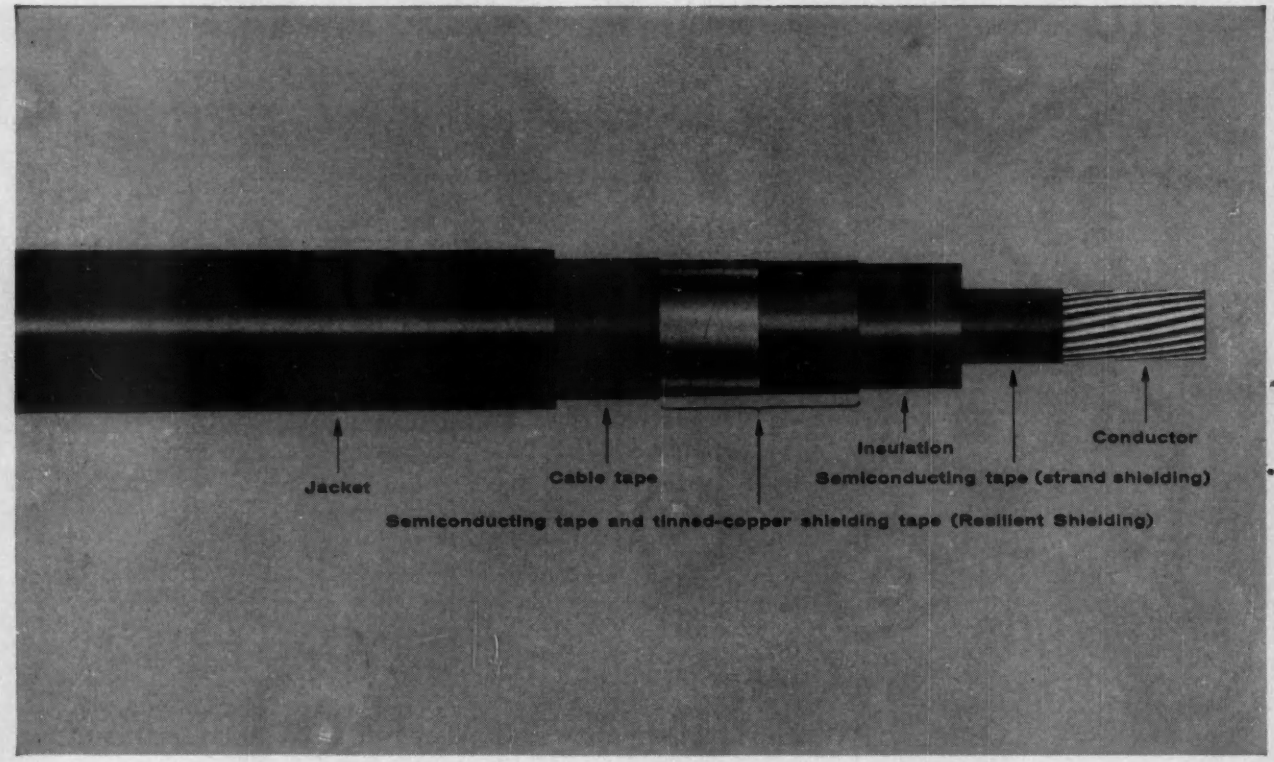
For convincing proof of Type RS Resilient Shielding, note the very good results in the chart above. The cable was identical with that tested on the left, with the exception of Resilient Shielding instead of conventional. Power factor remains almost unchanged after 180 load cycles, indicating the insulation remains unchanged too – the direct result of practically perfect protection by Resilient Shielding.

It is clear from this chart that Resilient Shielding keeps the insulation safe from the destructive effects of ionization and corona, even at elevated temperatures and at electrical stress above rated voltage. It maintains the integrity of the insulation . . . lengthens cable life!

For technical data on the tests reported here, see *Application of Polyethylene-Insulated High-Voltage Power Cable in Chemical Plants*, AIEE Transactions, Vol. 75, Part III, Sept. 4, 1956.

ANACONDA®

HIGH-VOLTAGE RESILIENT-SHIELDED CABLE →



Specifications for cable with Type RS Resilient Shielding

Polyethylene-Insulated: uncoated stranded conductor; strand shielding; natural polyethylene insulation to the required thickness; a layer of semiconducting tape of substantial thickness; tinned-copper shielding tape; cable tape, and for single-conductor cable, a suitable thermoplastic (such as Anaconda DENSHEATH*) jacket over-all. 57307

*Reg. in U.S. Pat. Office

SEE THE MAN FROM **ANACONDA®**

FOR TYPE RS RESILIENT-SHIELDED POWER CABLE

Anaconda Wire & Cable Company

25 BROADWAY, NEW YORK 4, N.Y.

Now... Talk through noise

NEW TRANSISTORIZED POWER VOICE speaker

The secret is in the exclusive **"GOLDEN HEART"** *transistor*

Hear your mobile radio HUNDREDS OF FEET AWAY

Now your vehicles, in fact any mobile radio equipped vehicle, can get far greater volume than ever before, with the new Motorola transistorized Power Voice Speaker.

This new compact, inexpensive speaker-amplifier combination delivers 10 TIMES MORE POWER than the conventional passive speaker. No more straining to hear messages. Just turn it up—it's got all the volume you'll *ever* need, all in this one small package. No longer is your driver shackled inside his vehicle...he can move about freely, hundreds of feet away, and still hear his dispatcher.

Secret of Motorola's newest development is the built-in transistorized amplifier, utilizing two long-life, Motorola power transistors. With the average 12 volt mobile radio system, the new speaker develops *15 watts* audio output. Even on a 6 volt system, you get 5 watts output—*much* more than the conventional one watt speaker level.

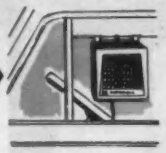
This power packed speaker is available for your mobile 2-way radio NOW. It can be quickly and easily added to most 6 or 12 volt installations. With the new Power Voice Speakers doing a bigger, better job for you, you'll also find low battery drain, bandpass response that accents voice frequencies, and versatile Quick-detach mounting...in a compact, all-metal housing.

You must *hear* the new Power Voice Speaker to appreciate what this added power can mean to you. Write, phone or wire today...or mail the coupon below.

New POWER VOICE speaker mounts firmly under dash in same familiar position

BUT...

detaches in a second to be hung from vehicle window and may be heard clearly hundreds of feet away.



MOTOROLA... always FIRST with the NEWEST in TRANSISTORIZED EQUIPMENT

MOTOROLA
2-WAY RADIO

MAIL THIS COUPON FOR LITERATURE
or a demonstration

Motorola Communications & Electronics, Inc., Dept. 16
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☐ Please send me more information on the new Power Voice Speaker.

☐ I want to hear a demonstration of the Power Voice Speaker.

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HERE'S THE PRACTICAL SOLUTION TO AN IMPORTANT NETWORK TRANSFORMER MAINTENANCE PROBLEM:

Corrugated

500 Kva, 15 Kv

Grounding switch internally mounted

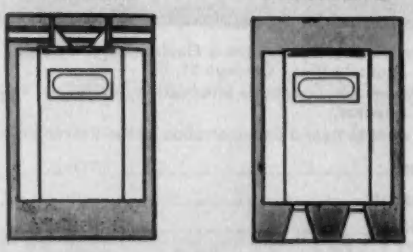
ONLY 50″ HIGH

Pennsylvania Network Transformers with Corrugated Cooling available in sizes 500-750-1000 kva. 5-15 kv.

Disconnect and grounding switch can be externally mounted.

CORRUGATED COOLED NETWORK TANK FEATURES

SUSPENSION MOUNTING OR PEDESTAL MOUNTING



CORRUGATED COOLING

for genuine ease of

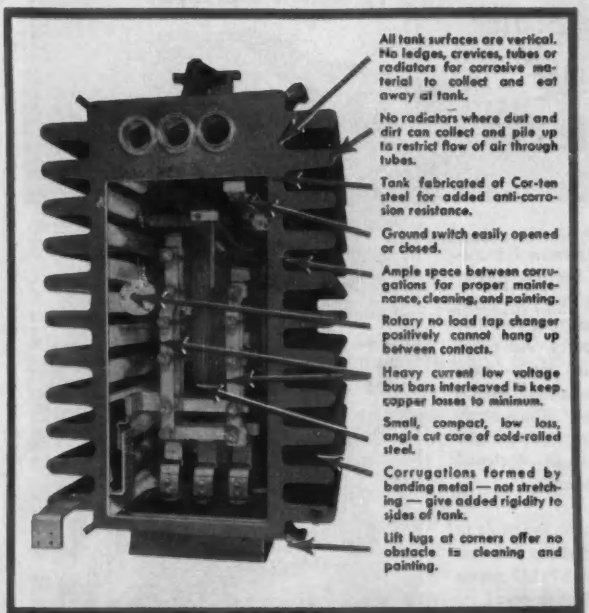
INSPECTION
CLEANING
PAINTING

Cooling*

IN PENNSYLVANIA'S NEW LOW-HEIGHT, SUBWAY-TYPE NETWORK TRANSFORMERS

In Pennsylvania's new subway-type network transformers, tank corrugations instead of conventional tubes and radiators provide the necessary radiating surfaces for proper cooling of the insulating liquid.

Tanks with smooth, vertical, corrugated surfaces have certain fundamental advantages for network transformers that are installed underground. They are easy to maintain properly in subway vaults where water, sludge, salt, and sewage are constantly eating and corroding away transformer cases and particularly transformer cooling tubes.


All tank surfaces are vertical. No ledges, crevices, tubes or radiators for corrosive material to collect and eat away at tank.
No radiators where dust and dirt can collect and pile up to restrict flow of air through tubes.
Tank fabricated of Cor-ten steel for added anti-corrosion resistance.
Ground switch easily opened or closed.
Ample space between corrugations for proper maintenance, cleaning, and painting.
Rotary no load tap changer positively cannot hang up between contacts.
Heavy current low voltage bus bars interleaved to keep copper losses to minimum.
Small, compact, low loss, angle cut core of cold-rolled steel.
Corrugations formed by bending metal — not stretching — give added rigidity to sides of tank.
Lift lugs at corners offer no obstacle to cleaning and painting.

* DESIGNED WITH YOUR MAINTENANCE PROBLEM IN MIND

The entire tank can be cleaned and even painted from a position above the transformer with complete assurance that the workman will be able to see and reach every bit of surface on the tank.

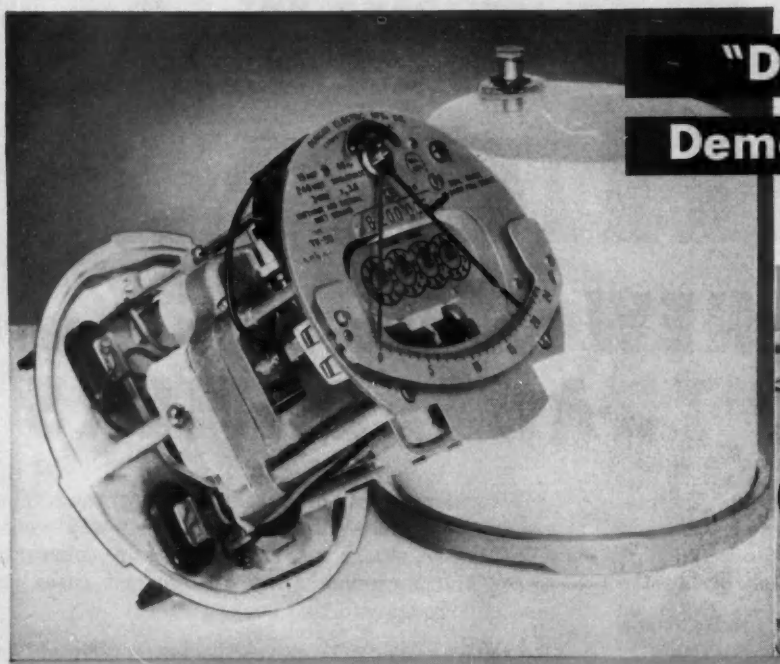
As a further measure of safety against corrosion, tanks, covers and bottoms are fabricated of Cor-Ten steel which has an inherent resistance to corrosion that is two to three times better than copper-bearing steel.

And there is more to this new transformer than Cor-Ten Corrugated Cooling. In the network transformer pictured here, where the grounding switch is mounted internally, the entire transformer, including the core and coils, was redesigned. It was reduced to two-thirds the size of the preceding model, which means it will fit into a small vault, or even replace a *smaller* Kva transformer in an existing vault. This particular model is only 50 inches high, and can be provided with brackets for suspension mounting, or pedestals for installation high above the floor of the vault.

If you are interested in learning more about these *really new* corrugated-cooled, subway-type network transformers, please contact Pennsylvania Transformer Company's Power Sales Department. Competent engineers will be happy to come to your office to discuss these transformers in complete detail.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division • **CANONSBURG, PA.** • *Greater Pittsburgh District*



"Dual Range" Demand Metering

New Meter Offers Choice of Demand Scales

Duncan TK "Dual Range" Thermal Demand Meter

● The new Duncan Type TK Singlephase Thermal Demand Meter is actually *two meters in one*. With a choice of scale capacities, either 12 KW or 24 KW, the meter can be matched to the load being measured. This is made possible by a range switch which interlocks with the demand scaleplate so that the electrical circuit is always connected correctly for either scale used—*see illustrations at right*. This change of scales may be made in the field without re-calibrating the meter; although some companies may prefer to make a calibration check.

The meter illustrated above is the socket type TK-SD. The corresponding bottom-connected type is TK-AD. The TK meter has the same *thermal element* that has been used successfully for over four years in Duncan Type TH polyphase meters. This high torque element minimizes the effect of any friction—thus greatly reducing maintenance. Errors in reading the demand due to parallax are minimized by the Kelvin or raised scale—putting it on the same level with the maximum pointer.

The Duncan MK *watthour element* is incorporated in the design of the TK meter. This 15-ampere element has adequate capacity for accurately metering continuous loads up to 100 amperes. All other features of the MK line also apply—such as arc-resistant molded-insulation, Alnico V damping magnet, microset adjustments accessible from the front, and rigid construction throughout—all designed for easiest possible maintenance.

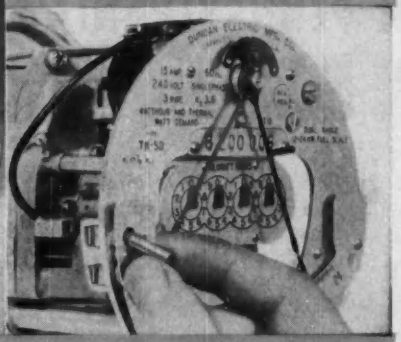
The dual range feature is also available in the Duncan singlephase 50-amp 240-volt 3-wire, 24/48 KW Type TF-SD meter for metering loads up to 200 amperes.

"Dual range" is a new concept in demand metering—one more feature of Duncan thermal meters—making possible low-cost demand measurement.

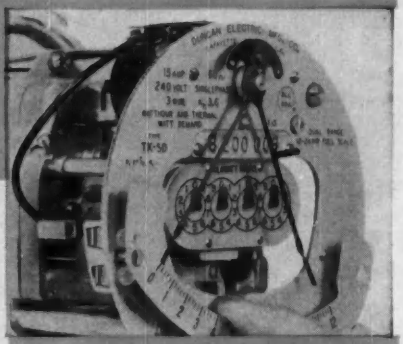
DUNCAN ELECTRIC CO., INC.
Lafayette Indiana

(Advertisement)

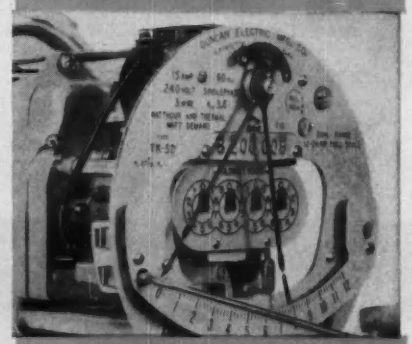
Changing Scale—



1. Remove three screws.



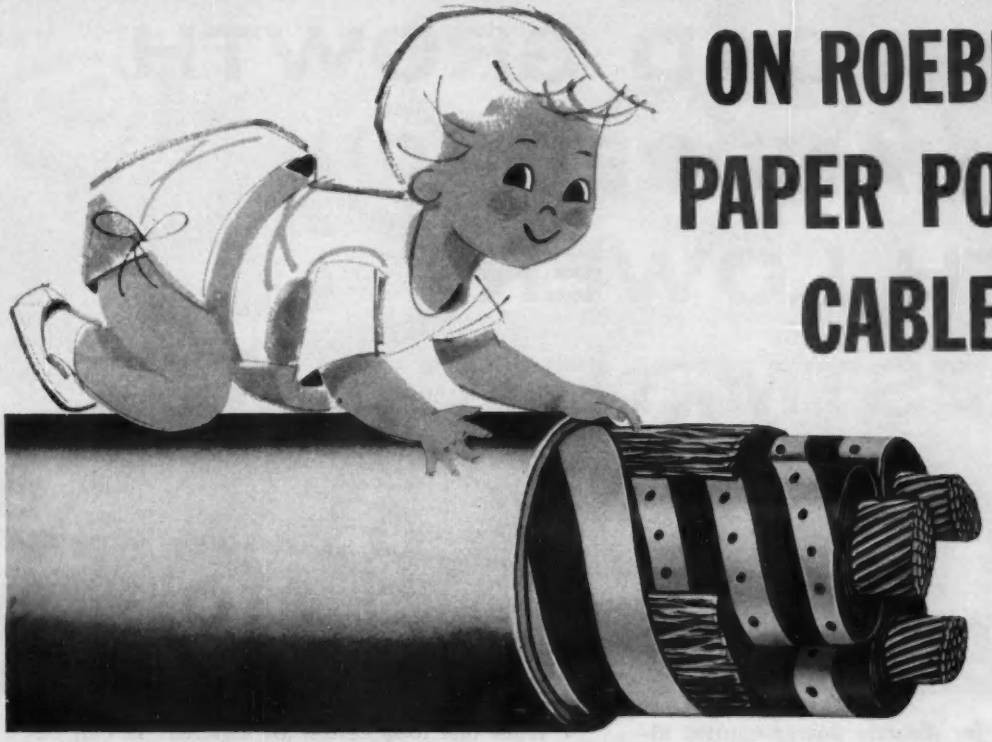
2. Turn scale over.



3. Replace screws. Note: One of the screws is a "switch contact" which is interlocked with a hole in the scaleplate to match scale being used.

Where CREEP is a problem . . .

TESTS PROVE 90% LESS CREEP IN TELLURIUM LEAD ALLOY SHEATHING ON ROEBLING PAPER POWER CABLE!



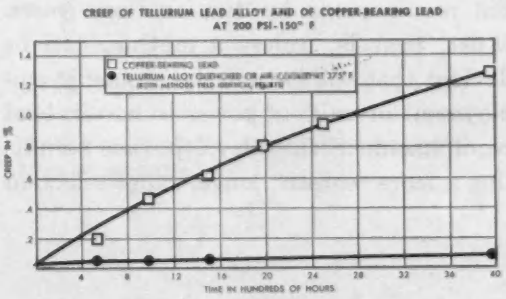
Roebling electrical wires and cables are available with either copper or aluminum conductors.

Only *one-tenth* the creep of ordinary cables—that's just one of the unusual properties of Roebling Tellurium Lead Alloy Sheathing on paper power cable, as shown by exhaustive creep tests in Roebling laboratories and by outside research. These impressive laboratory results are matched by field experience with thousands of feet of Roebling cable with Tellurium Lead Alloy Sheathing.

Look at the results on the graph yourself. You'll see that at 150° F Roebling Tellurium Lead Alloy Sheath stands up remarkably well, where copper-lead sheath, under the same conditions, stretches nearly 1.3% after only 4,000 hours at 200 psi.

Couple the unusual superiority of Tellurium Lead Alloy Sheath with the serviceable inner construction of Roebling Paper Power Cable—the uniform controlled-tension application of the paper tapes, for instance—and you have more than one reason why this cable is being specified by name, more and more, wherever power cable has to last a long, long time.

Write for full particulars today . . . rid yourself of cable problems tomorrow!



ROEBLING

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J.

Subsidiary of The Colorado Fuel & Iron Corporation

Branch Offices in Principal Cities

A question for every electric utility

CAN LOAD GROWTH BE HANDLED WITH LOWER INVESTMENT COSTS?

Our unequivocal answer to this question is, "Yes . . . and with greater power flexibility too."

Demand for electric power cannot always be controlled. Today's budding load growth area may well fall short of tomorrow's expectations.

The point is this: planning for increased power facilities necessarily precedes potential requirements by two to three years. Must, that is, unless a method can be devised that will permit the economic employment of units of power to handle load requirements as they develop, thus permitting a more realistic, longer-range selection of site and size for permanent installations.

Electro-Mobile Power provides the base for just such a program. It can be moved from one load center to another. It can be used in multiples to handle either building or diminishing demand. In short, it can follow the demand until such time as it becomes economic to build permanent facilities in the most advantageous location.

Can load growth be handled with lower investment costs? We think joint analysis of your own growth plans is the shortest way to an affirmative answer. Let's discuss it. Contact your nearest Electro-Motive representative for details.

As demand increases in the load growth area, Electro-Mobile rail units like this can be added or subtracted in 1000 kw increments to match power requirements exactly, at lowest cost. After demand has been established, permanent facilities can be erected in the most economical and desirable location. Electro-Mobile units offer the most advanced electrical engineering, equipment and controls. Rail units may be placed on sidings as shown here or mounted on piers for semi-permanent use.

Electro-Mobile trailer unit is remarkably adaptable to many temporary uses because of its quick mobility. Trailer units have 500 kilowatt capacity.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

LA GRANGE, ILLINOIS

Sales Offices in Chicago, New York, St. Louis, San Francisco

Reliable

SERVICE WEDGE CLAMPS

demonstrate that

the PROOF of a product is in

EXPERIENCE

EXPERIENCE in manufacturing

EXPERIENCE with use

When a manufacturer makes, and his customers use literally millions of his product, EXPERIENCE obviously indicates that the product is right. The valuable experience gained in manufacturing so many wedge type clamps means that utilities can buy and use them with confidence in their performance, their safety and their cost.

Reliable started with the telephone drop wire clamp, then came the concentric cable clamp and a little later the Service Wedge Clamp. Utilities from coast to coast know from experience that Reliable Service Wedge Clamps in a wide choice of types and sizes meet *all* their requirements.

FOR SERVICE DROP CABLES

Reliable offers 77 catalog numbers to provide the widest range of sizes and types in the industry.

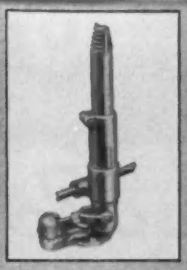
Specify and be sure to get the product that experience has proved best . . . Reliable Service Wedge Clamp.

Reliable ELECTRIC COMPANY

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

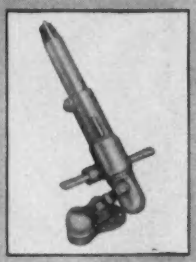
3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES



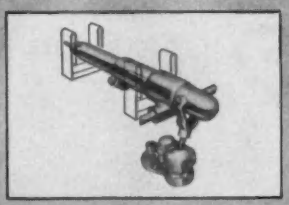
1. SWITCH BLADE IN FULLY OPEN POSITION

Universal link connects blade and crank arm for transmitting forces to the switch blade for full cycle of operation.



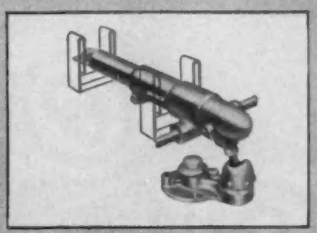
2. SWITCH BLADE CLOSING

Switch blade is moved from the open to closed position by a relatively small angular motion of the crank arm.



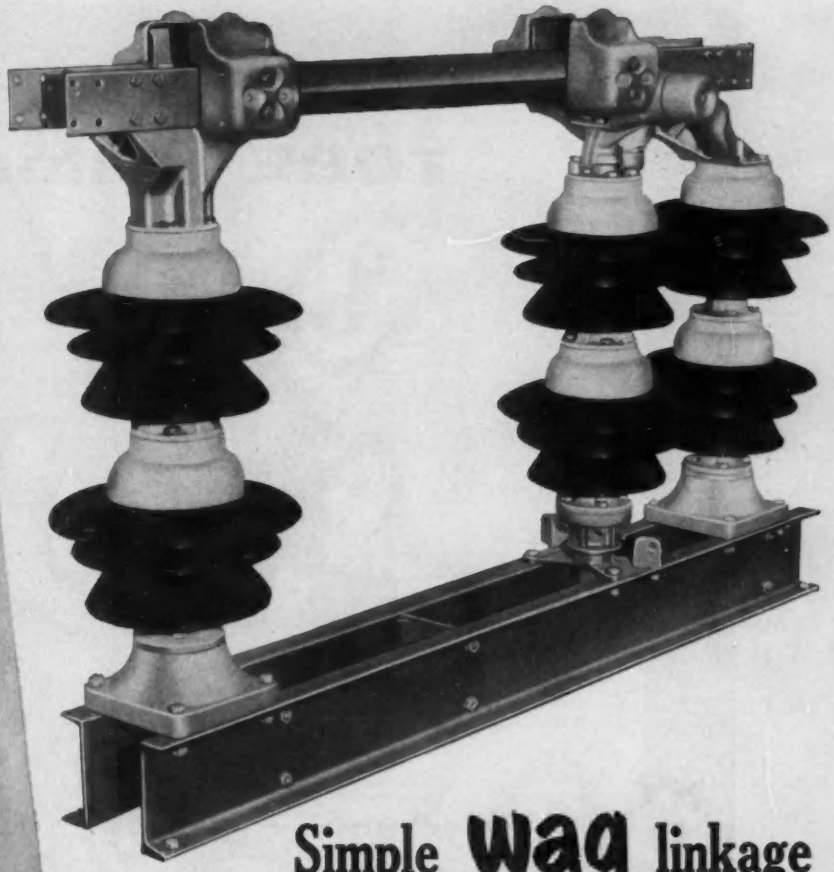
3. SWITCH BLADE ENTERS CONTACTS

In this position the switch blade begins its rotation for full contact engagement. Continued movement of the crank arm will rotate the blade to bring contacts under high pressure.



4. SWITCH WITH CONTACTS FULLY ENGAGED

The simple linkage of the WAG concentrates mechanical advantage so that contact engagement or disengagement is accomplished with a minimum of effort.



Simple WAG linkage boosts mechanical advantage; lessens operating effort

In one sweeping, continuous movement the Type WAG Switch blade swings into the open or closed position. There is no lost motion — no cams, triggers, or latches.

The WAG is operated by a simple system of cranks and levers arranged to transmit maximum torque when the blade rotates to engage or disengage the contacts. By concentrating mechanical advantage where it is needed most, the WAG can be operated smoothly and with less effort.

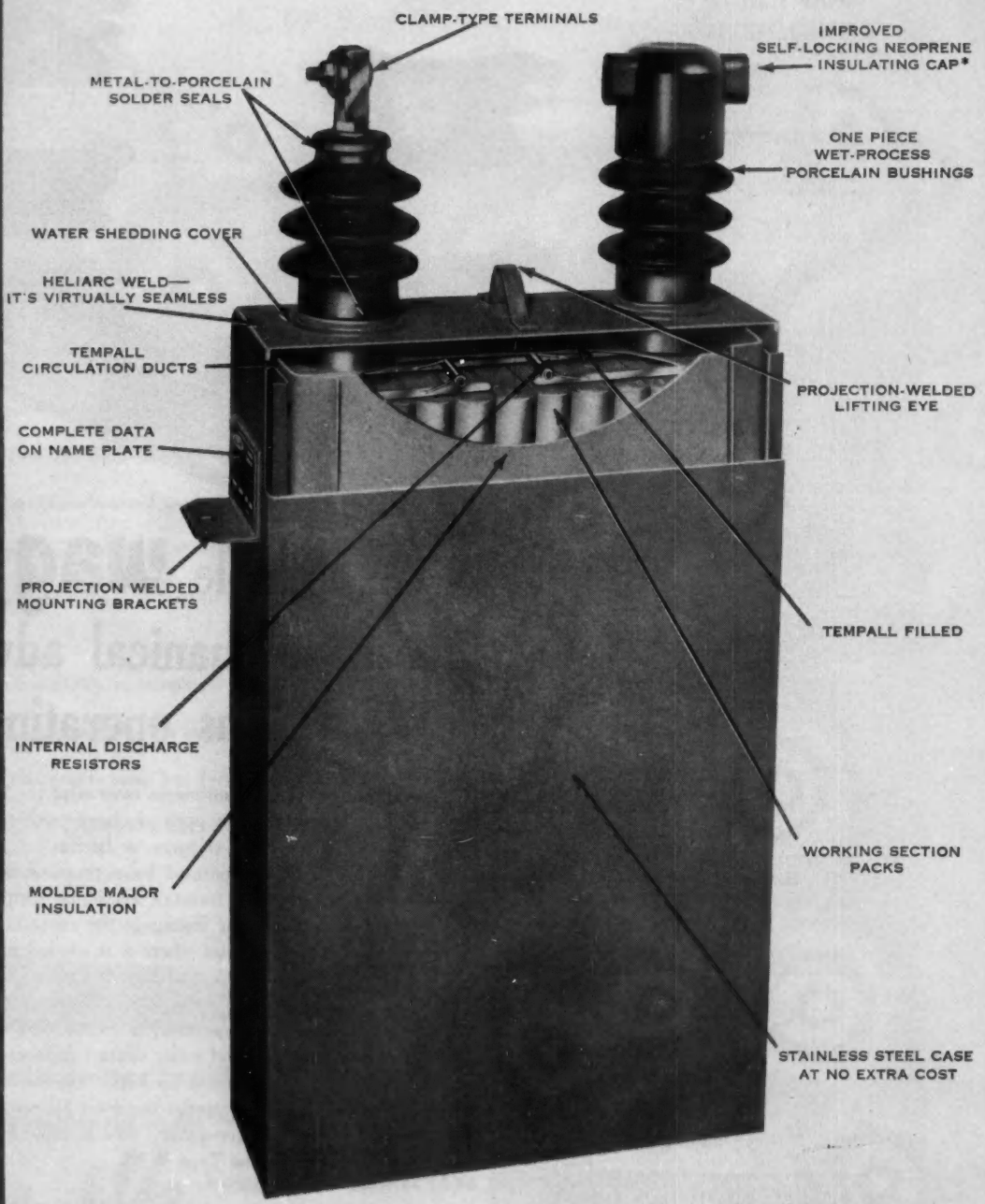
Thus, the Type WAG offers the advantages that engineers recognize as so important: a switch easy to operate, higher contact pressure, and wider contact deflection. The Type WAG has the muscle to break up heavy concentrations of ice and to operate dependably under the most adverse conditions.

For a premium quality switch capable of long, reliable service, choose the Type WAG.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

TOBE invites you to lo



ok inside the capacitors . . .

BEFORE YOU BUY A HOUSE, you look a lot farther than the color of the bathroom tile. You find out how the house is really constructed!

It's smart to be just as thorough when you buy capacitors.

Here are other TOBE *features which assure efficiency and long life in* TEMPALL CAPACITORS

- *Constant quality control of individual units during manufacture, processing and tests.*
- *Each unit visually inspected during manufacturing cycle to insure complete impregnation.*
- *Special* TOBE *assembly control mechanism results in greater product uniformity.*

Because of low losses resulting from TOBE's advanced engineering design and manufacturing technique you get more correction for your capacitor dollar.

It will pay you to investigate TOBE capacitors today. Available in all standard ratings. In single units, racks, pole assemblies and complete cabinets ready for field installation and energization. Write Tobe Deutschmann Corporation, Norwood, Massachusetts or phone Norwood 7-2620, collect for further information today.

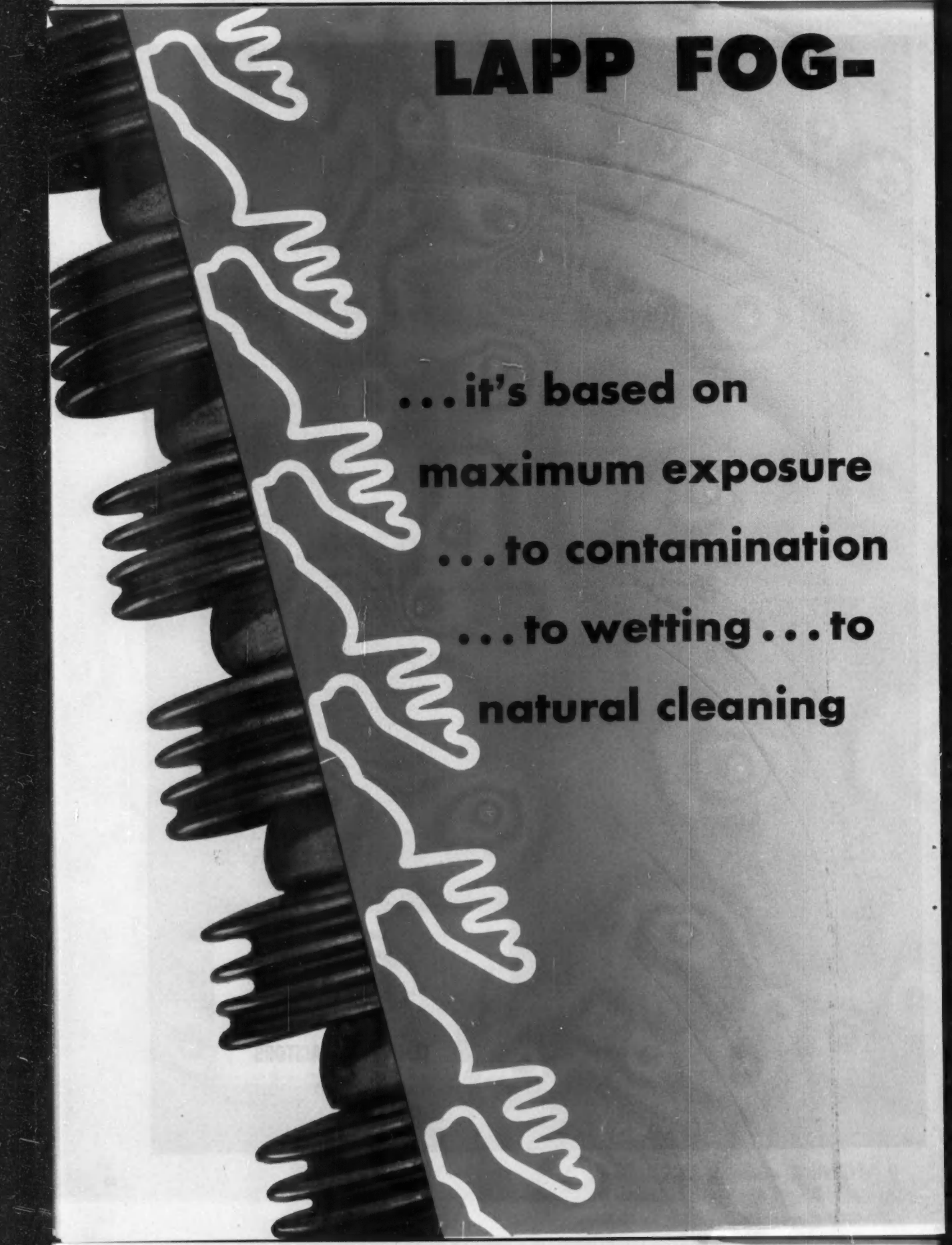
LOOK TO TOBE FOR PROGRESS

TOBE

TEMPALL CAPACITORS

Since 1929 persistent research, trustworthy engineering, rigid production standards.

*PATENT PENDING


LAPP FOG-
...it's based on
maximum exposure
...to contamination
...to wetting...to
natural cleaning

TYPE DESIGN

Nobody wants power arcovers. They cause service interruptions, set fire to equipment, add to maintenance costs, and pull line crews out of bed on foul nights.

But power lines do have to run through areas where dust, salt-spray, chemicals—even automotive exhaust fumes—combine with fog or rain to coat insulators with a conductive material such that leakage flashover can occur unless special steps are taken to avoid it.

The "special steps" begin, usually, with increasing the length of leakage path. The distinguishing characteristic of every "fog type" design is the extra inches of leakage distance it provides.

Dozens (maybe hundreds) of insulator designs have been produced for operation under contaminated atmospheric conditions. All have had extra leakage distance, but few have merited a second order by a user. So it must be that the geometry of the increased leakage surface has something to do with its effectiveness.

There is one design that has been successful. It has a record of more than thirty years on this job and has generally been adopted for all types of porcelain insulators for outdoor service.

This is a brief story of the technical considerations back of this design and of the reasons why it can save you money by reducing insulator cleaning, avoiding outages, and providing more dependable operation than is possible with any other type of insulator.

The effect of any contaminant, spread over all or part of an insulator surface, is to lower the surface resistance, thus allowing more leakage current to flow.

It is here that most errors occur in the thinking about contamination problems. Most people, at first thought, consider leakage current bad—that it should be prevented from flowing. As a matter of fact, however, it is the leakage current that saves the insulator, because it is continually drying and correcting the low resistance which fog or drizzle has caused.

Variations in thickness, width of path, and wetness in various areas of the surface result in non-uniform leakage surfaces. These variations are caused by the cleaning action of wind and rain, by non-uniformity in width of surface, by shielding parts of the surface from rain. When rain falls on a dirty insulator, resistance of the wet part is lowered. Since the total resistance is reduced, more current flows, but this current dries the shielded high-resistance areas even more rapidly. Thus voltage piles up over these high-resistance sections, showing increasing fire and arcing, precipitating flashover.

It's the dry, high-resistance areas of insulator surface that start flashover, and any attempt to shield insulators, or parts of them, is to invite flashovers by creating "hot spots" which initiate the flashovers.

The Lapp principle of Fog-Type design seeks uniformity and tries to obtain this uniformity by maximum exposure—to contamination, to wetting, to natural cleaning by wind and rain. It is typified by short petticoats, spaced to avoid pockets where contamination and moisture can accumulate. In the suspension unit, the smooth underside is also designed for maximum exposure with no restricting baffles to prevent cleaning. Spacing of petticoats is designed to obtain natural cleaning from water flow and splashing from below.

In most areas, no cleaning of Lapp Fog-Type insulators is required. Where a program of maintenance cleaning is necessary, time intervals for cleaning Lapp units may be extended beyond that required for other types of insulators, and the fully exposed leakage path makes such cleaning easy, fast, and economical.

The merit of this principle, and of the design, is confirmed by the service record of Lapp Fog-Type units. Those we ship today look just about like those we produced thirty years ago, and users of these thirty-year-old units have had little reason to look for new concepts of fog design. In the years since, the principle has been adapted to many types of outdoor insulators. Identical fog-type corrugations, used extensively today for high voltage bushings, have obsoleted the wide, spreading petticoats which were previously standard. Major advantages in performance, both mechanical and electrical, of Line Post and Station Post insulators are derived from the adoption of these designs of Lapp Fog-Type corrugations.

You improve the service record of your system, save your company maintenance expense, and improve the sleeping habits of your line crews every time you build a line on Lapp Fog-Type insulators.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Where will FIRE start in your plant?

Whatever the hazard, dip tanks, record storage vaults, spray booths, Kidde's carbon dioxide fire extinguishing system protects your plant 24 hours a day, gives you the fastest, safest fire protection ever made! Product of more than thirty years' experience, the Kidde system boasts more features than any other make on the market today. Features like:

All operating parts completely enclosed to guard against fouling or accidental operation.

No clumsy triggering methods or falling weights.

Self-contained; no outside power needed.

Visual indicators to show if system has been operated.

Easy testing of all operating parts.

No parts to replace after operation or test.

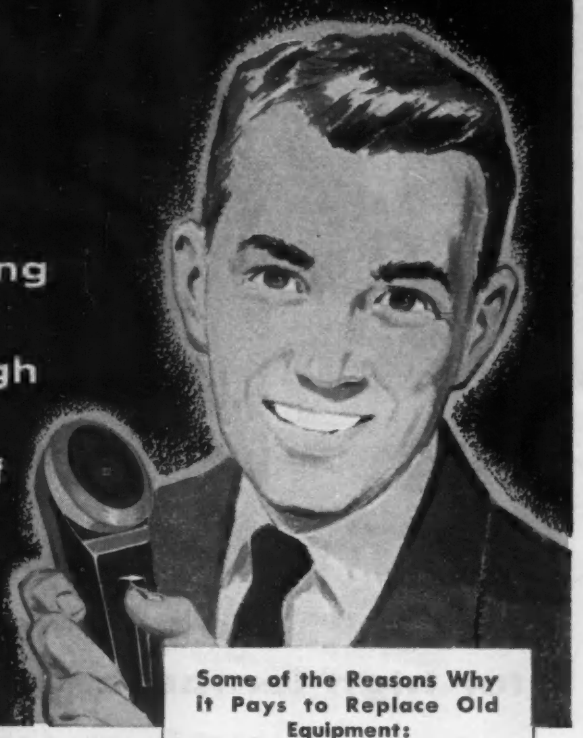
Fast-acting, clean carbon dioxide does the job that no other extinguishing agent can do: snuffs fire out in seconds, then vanishes into thin air. Won't harm valuable machinery, leaves no mess to clean up. Write for Kidde's pressure operated carbon dioxide fire extinguishing systems booklet today.

Kidde **Walter Kidde & Company, Inc.**
Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

REPLACE WITH RCA . . . AND SAVE!

You can own new RCA 2-Way Radio for what you are paying in inefficiency and high maintenance costs of obsolete equipment!



Some of the Reasons Why It Pays to Replace Old Equipment:

- *Improved performance from higher power*
- *Lower maintenance costs*
- *Reduction of downtime*
- *Opportunity for minimizing interference*
- *Improved operator morale*

The company that needs a new 2-way radio system is already paying for it in high maintenance costs and reduced efficiency. You're paying for the best—why not own it? With dependable new RCA mobile equipment, your investment will be protected for tomorrow with 6/12 volt interchangeability, and easily changeable components to provide split-channel operation. You'll get these plus assurances of lowest standby battery drain and low tube replacement costs, simplified "rainbow tuning," and other quality features only offered by the leader in radio and electronics.

An RCA Communications Representative will gladly explain how easy it is to own this dependable RCA equipment, including low-cost RCA financing and services of the RCA Service Company to keep your equipment operating at its peak. Mail coupon below for complete details.

RCA 2-WAY RADIO

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS

CAMDEN, N. J.

RADIO CORPORATION OF AMERICA
Communications Products
Dept. PB-45, Building 15-1, Camden, N. J.

☐ Please send me complete information on 2-Way Radio equipment for use in_____

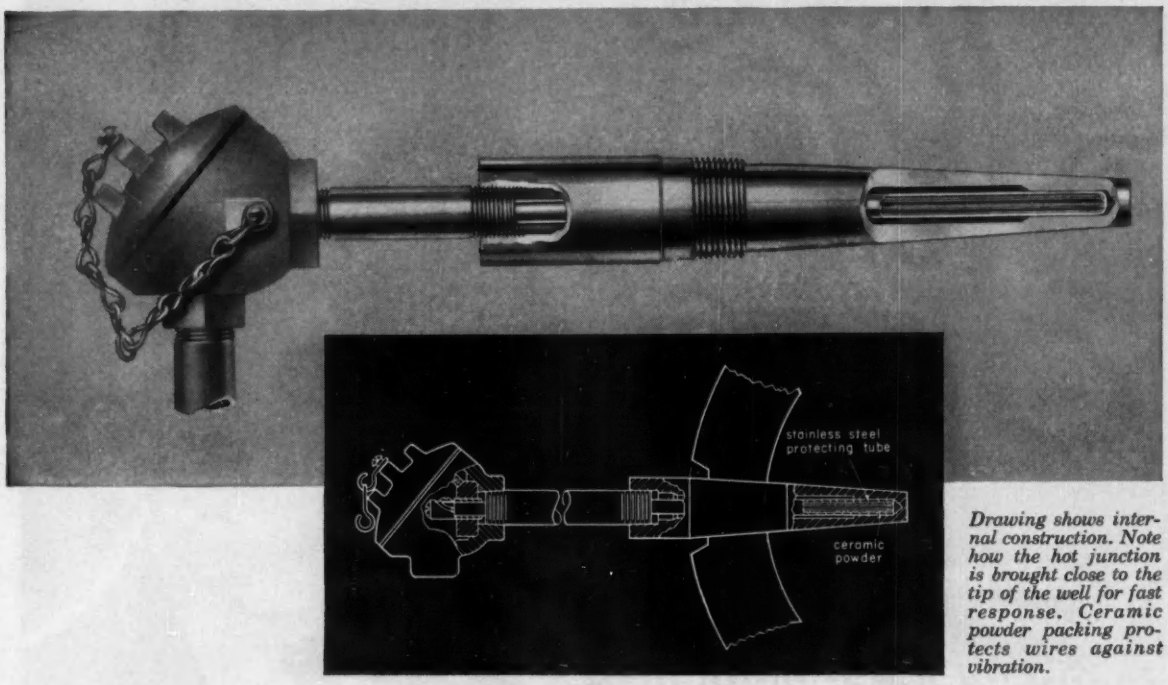
☐ Have RCA Communications Specialist make FREE radio survey of my business

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____



Drawing shows internal construction. Note how the hot junction is brought close to the tip of the well for fast response. Ceramic powder packing protects wires against vibration.

New Honeywell thermocouple for high-temperature, high-pressure steam

HERE'S a rugged, fast-acting thermocouple that is ideal for sensing temperatures in steam headers and feedwater lines. It's built to stand up under severe vibration . . . in the high temperatures, high velocities and high pressures of modern steam plants.

It is supplied in three styles . . . tapered and threaded, single-tapered for welding in a drilled hole, or double-tapered for pressure fit in a tapered hole. Designs are available for working pressures up to 5000 psig, temperatures to 1250 F., and velocity to 225 fps.

The thermocouple element is protected against vibration by an inert ceramic packing which holds wire in place inside a stainless steel tube. For high-speed response to temperature changes, the ends of the couple wires are fastened to the tip of this tube. The tube fits tightly into a drilled hole in the well... giving a short thermal path between the steam and the thermocouple. Thermocouples can be replaced without danger to personnel.

Either one or two thermocouples can be inserted in a single tube and well assembly, equipped with screw cover head. Either 15 AWG Type J or Type K thermocouples are used.

Your local Honeywell sales engineer will be glad to discuss how this new thermocouple can be applied in your plant. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Specification P58A, "New Honeywell Packed Thermocouple".**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

the O.Z. SHURELUG

has more of the features you want...

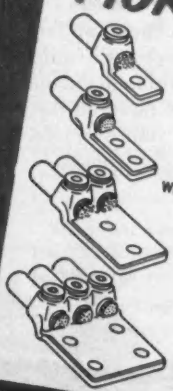
O.Z. means more for you

The O. Z. ShureLug is the newest addition to the complete O. Z. line of electrical fittings; more proof of O. Z.'s policy to make available dependable products at realistic prices.

MORE SIZES

The new O. Z. ShureLug is available for a wide range of sizes, including "in between" sizes usually found only in more expensive makes. This means that whether the job calls for #14 sol. or 1000 MCM cable, there will be an O. Z. ShureLug that will meet your needs more closely, more exactly, for a more secure, more dependable connection.

MORE MODELS



Here's variety too!: O. Z. ShureLug is available in single barrel, double barrel, and triple barrel models ... with socket heads or hex heads ... in single hole, double hole, and four hole styles, depending upon sizes selected. Here again, premium selection at practical prices!

MORE ECONOMY

O. Z. ShureLugs are priced no higher than other competitive brands, but you get so much more! Because O. Z. ShureLug is made in more sizes, more models, you buy only the capacity you actually need ... only the capacity that you'll actually use. Why spend more for over-sized lugs when O. Z. has the size you want, the model you need, at the low economical prices you want to pay?

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET · BROOKLYN 17, N. Y.

CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
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1945

THE FIRST . . . **FISHER-PIERCE PHOTOELECTRIC LIGHTING CONTROL**

. . . THE LATEST

1957

The year World War II ended, The Fisher-Pierce Company began work with utility engineers to develop photoelectric controls. Automatic, dependable switching of street lighting circuits when illumination was needed, regardless of time of day, season or weather, was the fundamental idea. The Series 61300 was the first of five different, major groups of F-P controls that have followed.

The experience has proved valuable to Fisher-Pierce and customers alike. Backed by an organization of more than 650 people, F-P today offers photoelectric lighting controls for all purposes . . . extensive sales and engineering services . . . research, development and production facilities to solve specific photoelectric/electronic equipment problems you may have. Your inquiry about F-P products, who uses them, and how you may use our development facilities for your own electronic equipment requirements, is welcomed.

THE FISHER-PIERCE CO., INC.

82 PEARL STREET, BOSTON 85, MASSACHUSETTS

A communications utility used its 702 to dig 18,000′ a month. One job—opening 2500′—cost one-third of the estimate . . . establishing a new low for underground cable installation.

Now you can place your cable underground at low cost

The many advantages of having electric and telephone cables underground have long been recognized. The chief obstacle has been the cost of digging and backfilling the required trench.

The new Barber-Greene 702 Ditcher has solved this problem. Despite its small size, the 702 is the newest machine in the most rugged line of ditchers made.

Prior to this new development, available machines either dug too wide for practical and economical operation, or did not have the stamina and digability required for coping with unfavorable conditions.

Utilities, contractors and railroads are now gaining the advantages of underground lines and services in virtually every area of the country.

Applications, to date, include electric power and telephone lines and house services, railroad signal systems, traffic control systems, outdoor theater wiring, installations of small gas and water lines and services, lawn sprinkling systems, and others.

Digs to 40″ deep, 5″ wide. The 702 can be towed or carried on a light truck. Simple dual controls permit operation from seat or from side of machine for full view of trench.

56-10-D

Write for literature on this important, new, low-cost ditcher

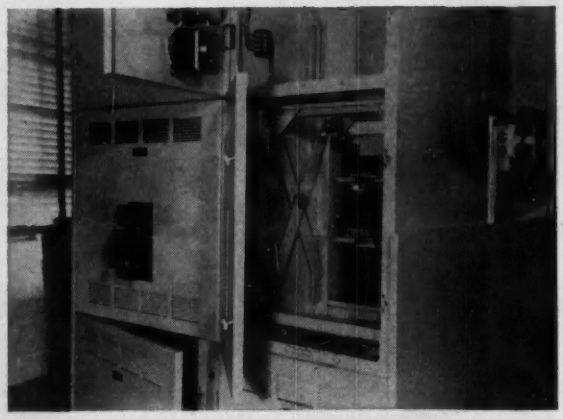
Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

SECONDARY UNIT SUBSTATIONS

ENGINEERED AT I-T-E and coordinated to meet the operating conditions found in your plant.

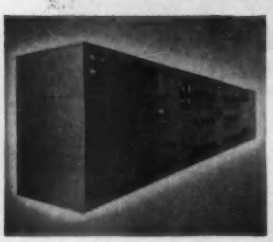


BUILT AT I-T-E with such extra features as circuit breaker test-position with doors closed.

TESTED AT I-T-E to assure ease of installation, and top performance under operating conditions.

SHIPPED FROM I-T-E to assure prompt delivery of one complete "package," ready to install.

I-T-E MAKES IT EASY TO BUY COMPLETELY COORDINATED UNITS



Only I-T-E builds transformers and switchgear in the same plant. This permits them to assume all responsibility for your unit substation requirements. Close association of engineering and production relieves you of detailed planning, paperwork, and the problems of coordinating deliveries. Shipment is from one location. Installation is speeded. Substation components are completely integrated to provide top performance at low overall cost.

Typical of the extra value which *only* I-T-E Unit Substations offer is circuit breaker test-position with doors closed—and without removing them. This means additional safety to operating personnel, greater cleanliness, simplified tagging out of circuits, and longer life. I-T-E Secondary Unit Substations can be supplied for any application, indoor or outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Or write I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

Looking for a NEW Electric Water Heater Line?

question:

Here are the Electric Water Heaters that put more *salespower* behind "HOUSEPOWER"—more *living* in "LIVE BETTER . . . Electrically!"

answer:

HOTPOINT CONTINUES ITS FULL LINE OF INDUSTRY-LEADING WATER HEATERS TO MEET ALL LOAD-BALANCING CONDITIONS!

maximum **public acceptance • engineering superiority • completeness of line**

½ of all Electric Water Heaters ever built have been built by Hotpoint!

They're easiest to sell—first choice in over one million American homes!

They're easiest to install—No tricky hook-ups. No long pipe runs. No special tools or skills needed.

Service is no problem—Only 3 out of every 1,000 Hotpoint Water Heaters have ever needed servicing of any kind!

Here are just a few of Hotpoint's outstanding features . . .

- Calrod® Magic Circle® heating units grip outside of tank with pressure of 200 pounds—heat is efficiently transmitted to water.
- Automatic Thermostats—mounted directly on tank for sensitive, accurate temperature control.
- Finest Fiber Insulation—permits storage of hot water for 3 days without heating.
- Copper hot water trap—"hot-dip" galvanized steel tank—cold water baffle—Listed by Underwriters' Laboratories, Inc.—full Hotpoint Warranty.

Also available are Quick-Recovery Super Speed models and cement-lined Perma-Stone models that can't rust.

Round models in sizes from 30 to 82 gallons.

Table-top models in 30, 40, 50 gallon sizes.

Built-in models in 30, 40, 50 gallon sizes. A real low-cost "Builder" unit that can be installed under kitchen counters, in bathrooms, linen closets, etc.

You'll build maximum water heater revenue by giving your customers the finest, most famous in Electric Water Heaters —so contact your Hotpoint Distributor today!

Again, Hotpoint *looks at Tomorrow, Today!*

RANGES • REFRIGERATORS • AUTOMATIC WASHERS • CLOTHES DRYERS • DISHWASHERS • DISPOSALLS® • WATER HEATERS • FOOD-FREEZERS • AIR CONDITIONERS • CUSTOMLINE • TELEVISION

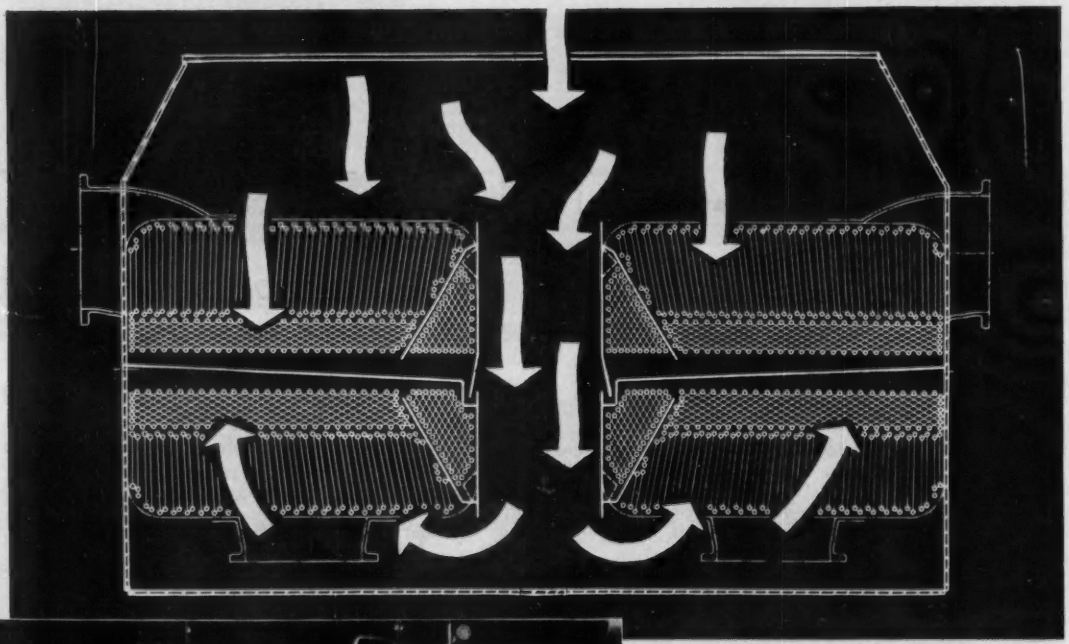
HOTPOINT CO. (A Division of General Electric Company) 5600 West Taylor Street, Chicago 44, Illinois

115 large Foster Wheeler

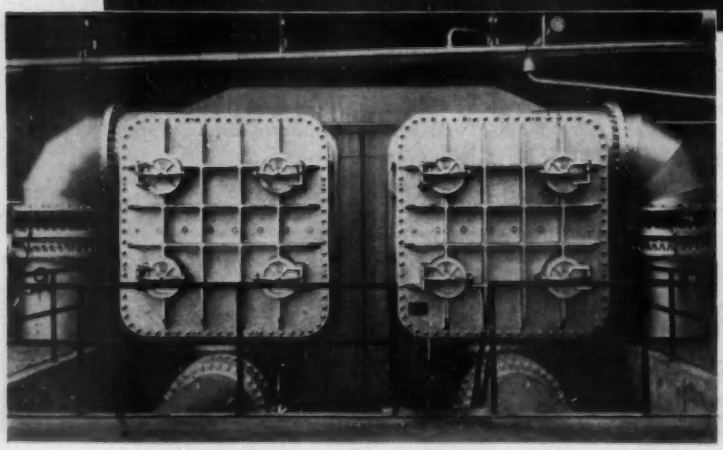
16 MILLION

Turbo-generator

Foster Wheeler has installed or is building Steam Surface Condensers for 115 turbo-generators of 100,000 kw capacity or larger, with a total output capability of over 16,000,000 kilowatts



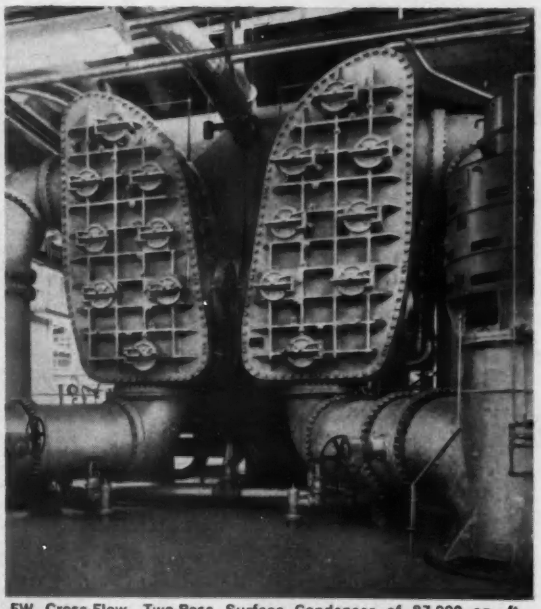
Transverse sectional elevation of FW double-flow, two-pass condenser, for installations requiring minimum headroom.



FW Double-Flow Surface Condenser of 70,000 sq. ft., serving a 100,000 kw turbo-generator at the L. V. Sutton Station, Carolina Power & Light Co.

Condensers for KW Capacity

THE NUMBER of large Foster Wheeler Surface Condensers now installed or on order — and the total kw capacity of the generators which they serve — is an indication of their outstanding acceptance by the power industry. This, together with the high percentage of repeat orders, reflects the dependability and long-term economy of Foster Wheeler condensers, as demonstrated by on-the-job performance in leading power plants from coast to coast. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*



FW Cross-Flow, Two-Pass Surface Condenser of 87,000 sq. ft., serving a 125,000 kw turbo-generator at the Barry Station, Alabama Power Co.

FW CONDENSERS SERVING TURBINES OF 100,000 KW OR MORE

CUSTOMER	STATION	No. of Units	CUSTOMER	STATION	No. of Units
Alabama Power Company	Gorgas Station	5	Louisville Gas & Electric Co.	Cane Run Station	3
Alabama Power Company	Barry Station	2	Mississippi Power & Light Co.	Rex Brown Steam Plant	1
Aluminum Company of America	Sandow Plant	3	New Orleans Public Service, Inc.	Michoud Steam Plant	1
Aluminum Company of America	Warrick Plant	3	Omaha Public Power District	North Omaha Plant	2
American Gas & Electric for Ohio Power Co.	Tidd Station	1	Oklahoma Gas & Electric Co.	Riverbank Station	1
Arkansas Power & Light Co.	Cecil Lynch Station	1	Oklahoma Gas & Electric Co.	Horseshoe Lake Station	1
Arkansas Power & Light Co.	Harvey Couch Station	1	Oklahoma Gas & Electric Co.	Mustang Station	1
Carolina Power & Light	L.V. Sutton Station	1	Pacific Gas & Electric Co.	Station "P"	2
Carolina Power & Light	Cape Fear Station	2	Pacific Gas & Electric Co.	Moss Landing Station	5
Central Hudson Gas & Electric Corp.	Danskammer Point	1	Pacific Gas & Electric Co.	Contra Costa Station	2
Central Illinois Public Service Co.	Grand Tower Plant	1	Pacific Gas & Electric Co.	Pittsburg Plant	4
Central Nebraska Pub. Power & Irr. Dist.	Canaday St. Plant	1	Philadelphia Electric Co.	Southwark Station	2
Commonwealth Edison Company	Crawford Station	1	Public Service Co. of Indiana, Inc.	Wabash Station	4
Commonwealth Edison Company	Joliet Station	1	Public Service Electric & Gas Co. of New Jersey	Marion Station	1
Consumer's Power Co.	Weadock Station	1	Public Service Electric & Gas Co. of New Jersey	Sewaren Station	4
Consumer's Power Co.	B.C. Cobb Station	1	Public Service Electric & Gas Co. of New Jersey	Kearny Station	2
Consumer's Power Co.	Dan E. Karn Station	1	Public Service Electric & Gas Co. of New Jersey	Linden Station	2
Dallas Power & Light Co.	Parkdale Station	1	Public Service Electric & Gas Co. of New Jersey	(undisclosed)	1
Dallas Power & Light Co.	Mountain Creek Station	1	Super Power Co. of Illinois	Powerton Station	2
Florida Power Corporation	Paul Bartow Station	1	Tennessee Valley Authority	Widows Creek Steam Plant	6
Florida Power & Light Co.	Fort Lauderdale Plant	2	Tennessee Valley Authority	Shawnee Steam Plant	10
Florida Power & Light Co.	Fort Myers Plant	1	Tennessee Valley Authority	Colbert Station	4
Florida Power & Light Co.	Site unsettled	1	Texas Electric Service Co.	Graham Station	1
Georgia Power Co.	Plant Yates	3	Texas Power & Light Co.	Morgan Creek Station	1
Houston Lighting & Power Co.	Sam Bertron Station	3	Tokyo Electric Co.	Chiba Station	1
Houston Lighting & Power Co.	Smithers Lake Station	2	Union d'Electricite, Paris	Genevillers Power Station	1
*Hydro-Electric Power Commission of Ontario	Richard L. Hearn Generating Station	1	United Illuminating Company	Bridgeport Station	1
Kansas City Power & Light Co.	Hawthorne Station	1			
Kansas Gas & Electric Co.	Murray Gill Station	2			
Louisiana Power & Light Co.	Sterlington Station	1			

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Jaw variations make this the versatile, durable tool you can afford to put on every truck. Low in cost, big in performance this new 4¾ lb. MD5 delivers a 6000 lb. force to install a range of distribution connectors on all conductors through 2/0 ACSR.

It's designed to stand the roughest field treatment. Jaws are of heat treated steel. A set screw adjustment compensates for wear. Die letters or numbers on each groove correspond to connector markings to assure correct crimping. Handle grips color-coded for easy identification.

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Aluminum up thru 1/0, copper up thru #2 and
Crimpits, Eltaps, Linkits, etc. up thru 1/0

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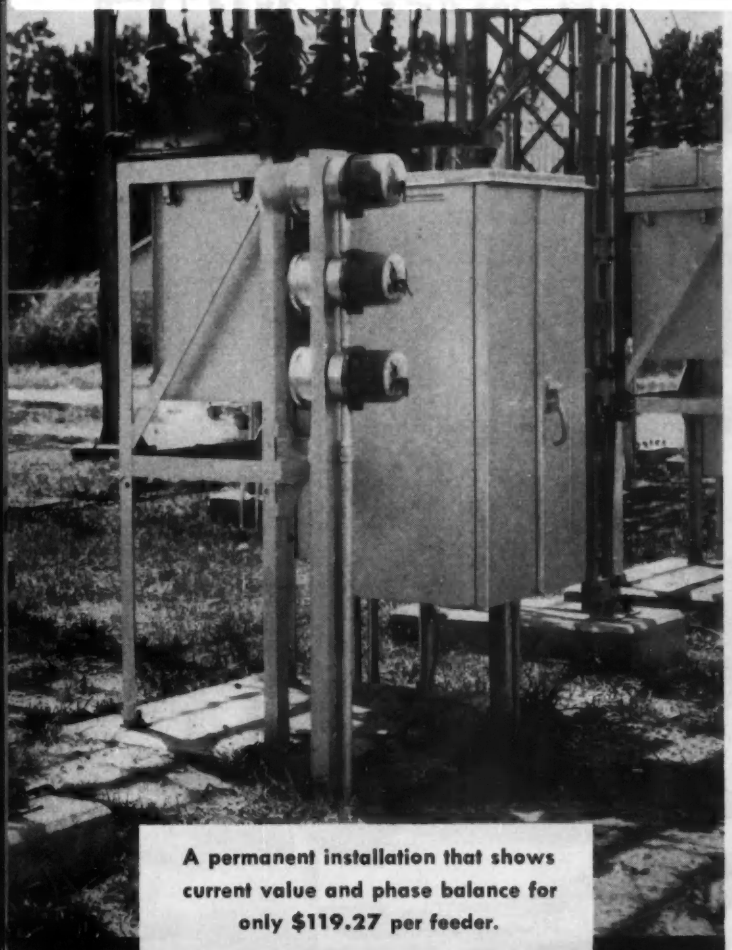


A permanent installation that shows current value and phase balance for only $119.27 per feeder.

LICK SUMMER LOADING PROBLEMS...

get complete phase-by-phase substation measurement with LINCOLN METERS

Now, you can get simplified measurement for system operation—at your substations—with a low-cost permanent installation of meter sockets and Lincoln "Indicating Meters with a Memory."

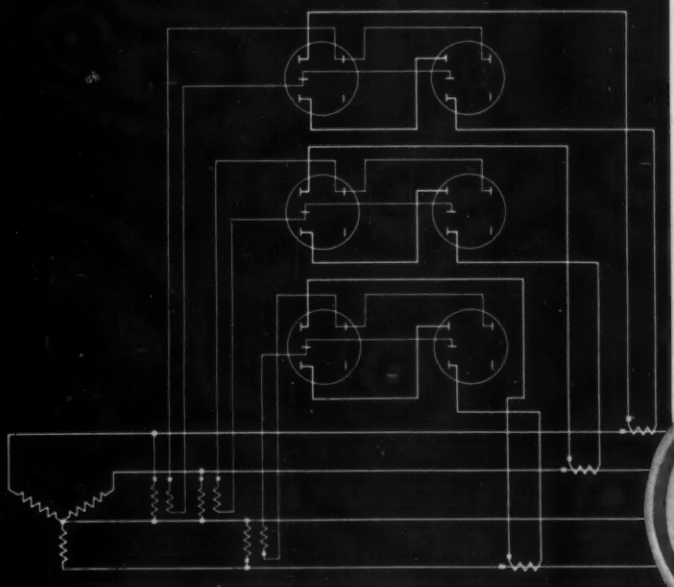
At left is shown one circuit in a substation with such socket-installed Lincoln Ammeters and a Voltmeter. This permanent installation shows current value and phase balance on the feeder and voltage on one phase. Its cost is surprisingly low:

BILL OF MATERIAL

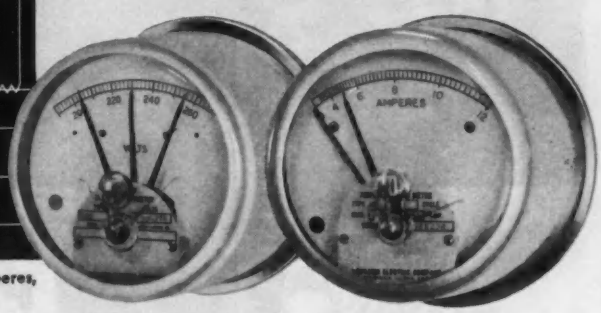
6 Sockets 1M134G1 @ $4.02	$24.12
3 ADS Lincoln Ammeters @ 22.00	66.00
1 V2S Lincoln Minimax Voltmeter	29.15
	$119.27

The installation is flexible, too. It includes provision for measurement of KW and KVAR. Socket type meters for this purpose can be installed in any of the sockets—or Lincoln Graphic Meters can be plugged in to record time and duration of system conditions. Any lineman can make the installation—no wiring changes are necessary. The socket makes the correct connection for the meter "plugged in."

Write for full information on Lincoln Meters and Simplified Measurement for System Operation.



Method of wiring 5 terminal transformer type meter sockets for measurement of amperes, volts, watts or vars in each phase of three-phase, four wire Y primary feeders.



SANGAMO ELECTRIC COMPANY

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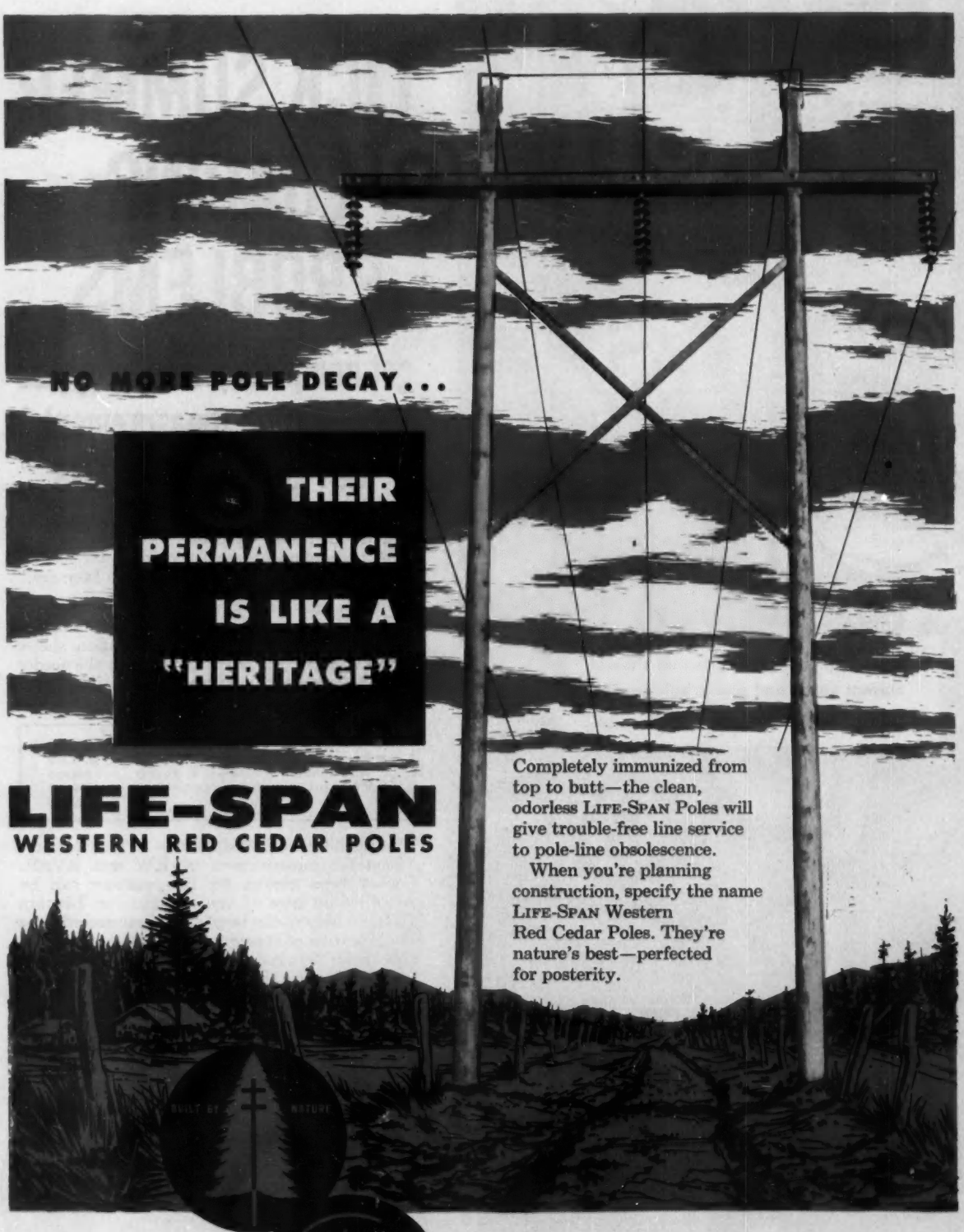
SM57-2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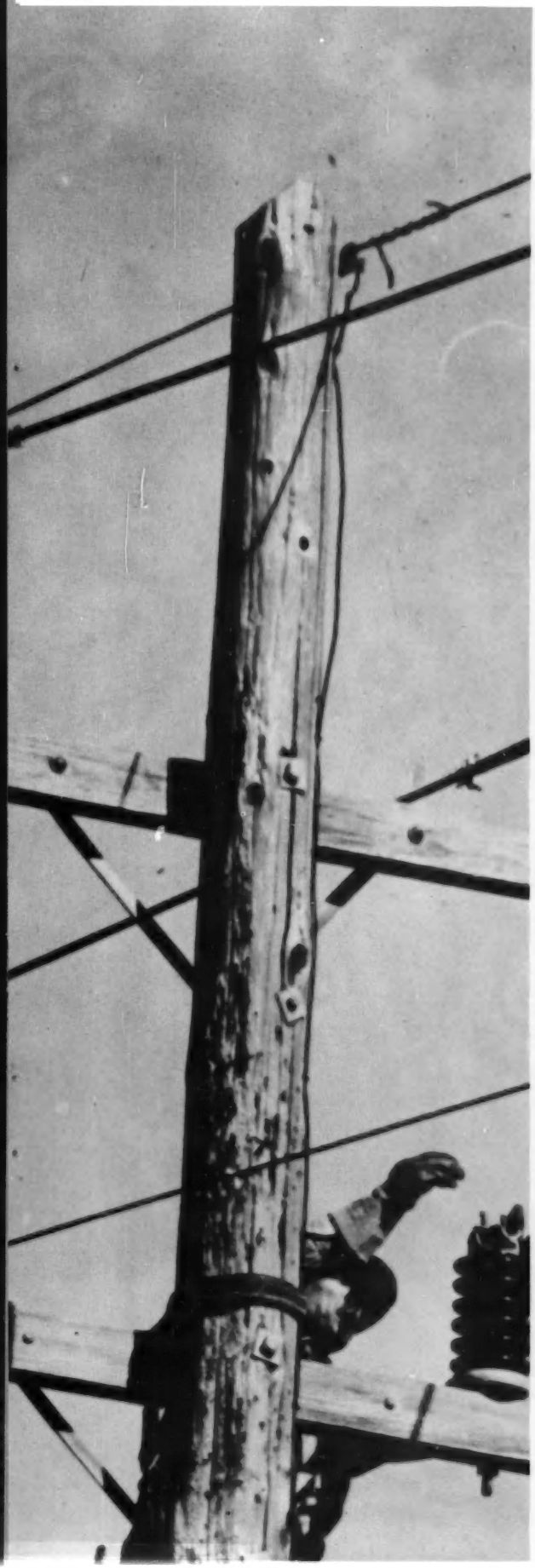


CUSTOMER'S CHOICE!

Clamp or Tie, on Pin or Post

O-B supplies them all

You pick what's best for you

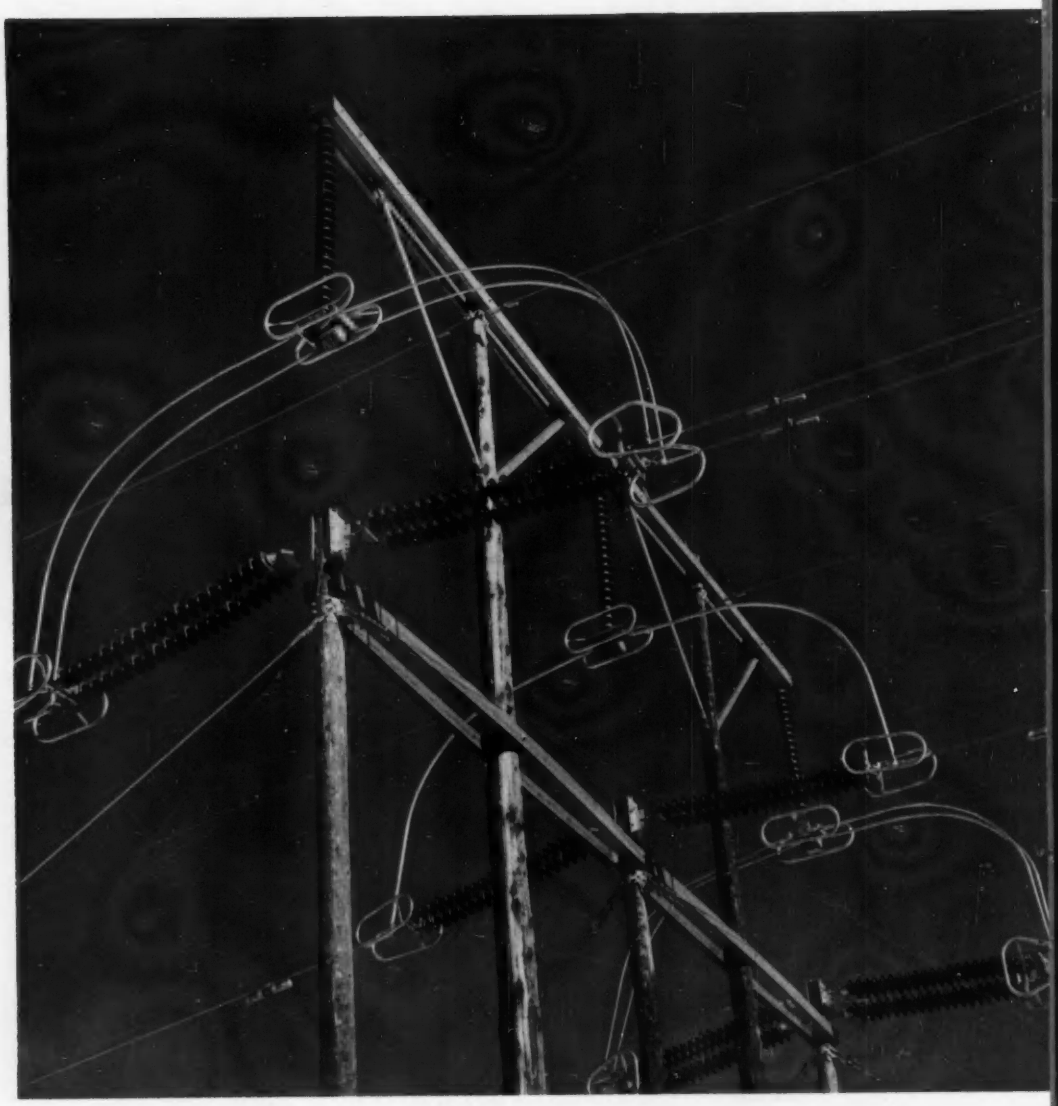
In the O-B lineup of insulators, you find both pintypes and line posts, with each type available with either tie-top or clamptop.

This is our practical way of showing that only you — the customer — know what's best for your system. You pick the type that works best for you. We concentrate on making all types to give you the best possible service.

Through the years, this has proved to be a highly satisfactory approach for both you and us. O-B insulators have served longer and in greater numbers than any other brand. We assure you that those you install today will serve even longer.

Ohio Brass

Transmission news is being made at Leadville



Colorado Public Service test expected to provide basic information on EHV transmission at high altitudes

O-B insulators and hardware are making an important contribution to the extra-high voltage transmission test at high altitude being conducted by Colorado Public Service Company at Leadville.

Since the test is primarily on conductor and conductor arrangement, one of the requirements of the O-B shielding devices was that their radio and corona characteristics be equal to or better than the best supported conductor arrangement. Such shielding devices were developed and their performance tested in the O-B high voltage laboratory before they were sent to Leadville.

Testing on insulators and hardware supplied for Leadville revealed that they need not place any upper limit on transmission voltage magnitude. In other words, you can take voltage as high as you want to. The insulators and hardware can be supplied to handle it.

Ohio Brass is proud to be cooperating in the Leadville experiment because we know valuable information to the power industry will come out of it.

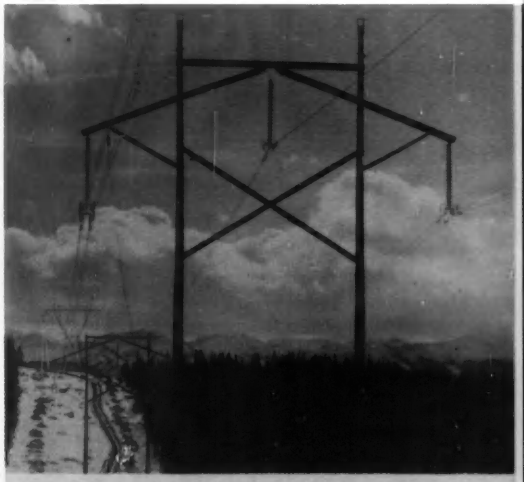
Remember, we're always ready to help you with any problems you may have pertaining to extra-high voltage transmission.

OHIO BRASS COMPANY, MANSFIELD, OHIO

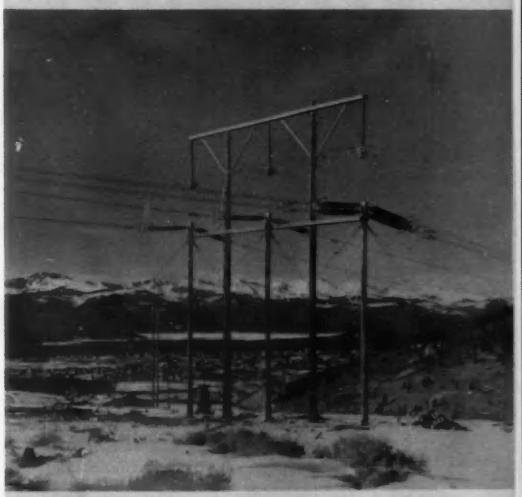
CANADIAN OHIO BRASS CO. LTD., NIAGARA FALLS, ONT.

Ohio Brass

Note: A group of papers (AIEE No. 57-161) has been prepared describing the Leadville project. A copy can be obtained from Ohio Brass Co., free of charge. Ask for OB Publication No. 1381-H.

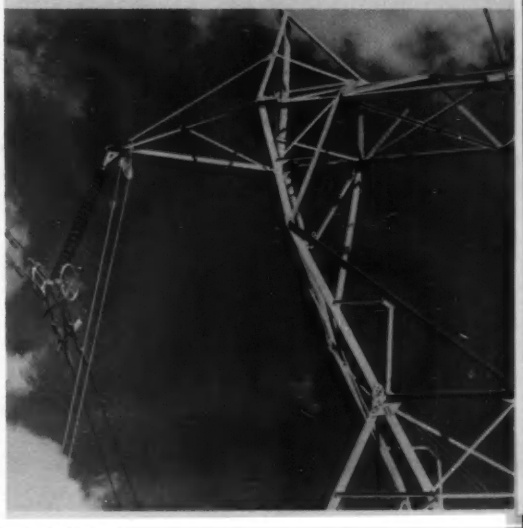


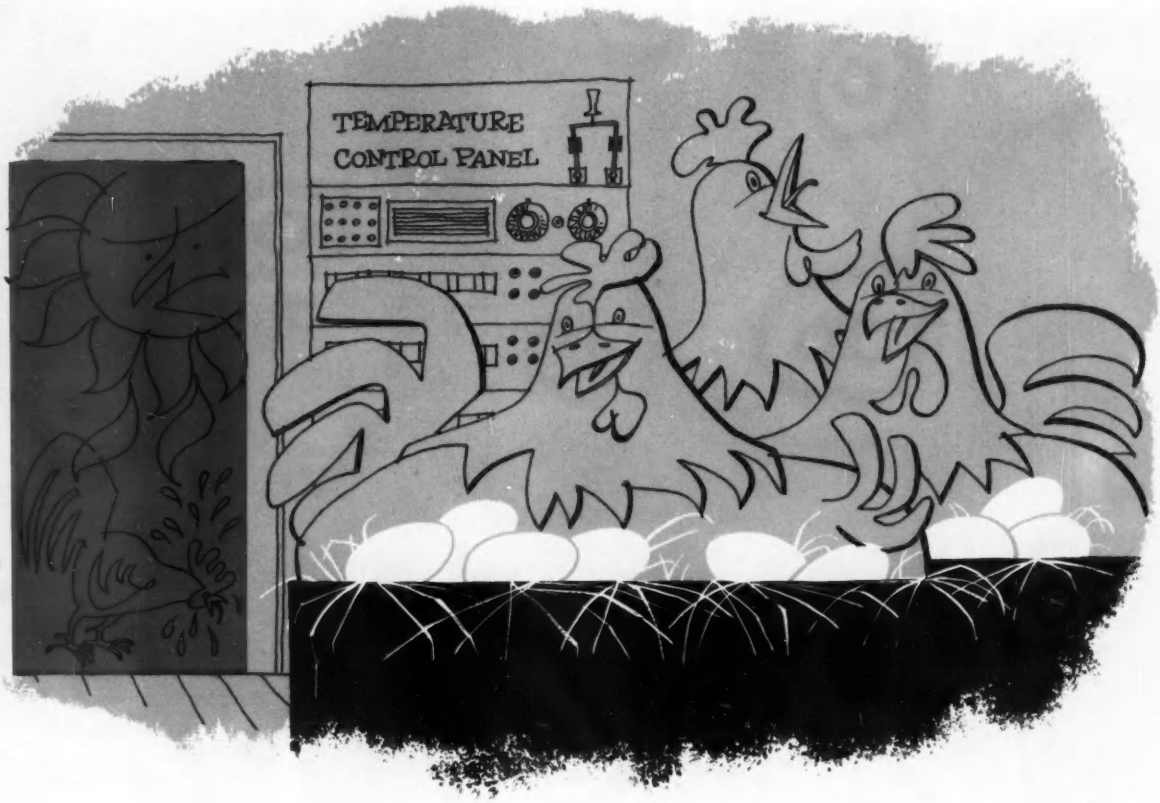
Leadville line has eight suspension towers plus one deadend and switching structure and one deadend tower.



Special five-pole deadend which was built so that radio influence choke coils could be used to eliminate interference from secondary lines in the area.

Test conductors were suspended on strings of 20 10-inch insulators with 5¾-inch spacing. Control rings were designed to eliminate insulators and hardware as factors in radio influence studies.





Man, those hens are cool

and even more important, they lay more eggs

A Texas college reports that air-conditioning the hen house does more than keep the hens cool. It also boosts egg production by 20 per cent.

We also know that pigs get fat sooner when they have a cool place in summer, and the cows turn out more butter fat when the dairy barn is air conditioned. No doubt the farmer himself is more efficient when he can sleep in an air-conditioned house.

Now that we've made the case for air conditioning, comes the next consideration. It's quite a load builder for your system. Along with the other new appliances, air conditioning equipment will soon have distribution voltages climbing again.

Graybar is ready to help you get ready for the bigger load. You'll find your nearby Graybar house stocks all the O-B insulators and hardware you need for a voltage-raising program. Bring Graybar into the planning soon. After all, we don't want to disappoint those hens when they start clucking for air conditioning. Do we?

OHIO BRASS COMPANY, MANSFIELD, OHIO

4744-H

Standardization: A Case in Point

There were a number of reasons why Athens, after almost five centuries as the recognized center of cultural and commercial life in the ancient world, succumbed to Sparta. Among the most important was the inability of the Athenians to agree on details concerning the defense of their city. They pursued their separate ways in the face of a crying need for unity. Sparta exploited this and the rest of the story is history.

There is a lesson for our industry in what happened to Athens—for both utilities and manufacturers alike.

It is simply this:

There are certain fields of endeavor in which we must act in unity, certain areas in which we must *standardize*.

General Electric's recently announced decision to reduce the number of models in its water heater line is an excellent case in point. Because utilities throughout the country could not get together and draft a few sets of common specifications to cover their water heater needs, GE, Hotpoint, and other manufacturers are forced to make more than 175 different models.

Let's do a little research using water heater figures in 1956 as an example. According to NEMA, the number of all water heaters sold in 1956 totaled 870,000. Now there are 55 manufacturers of electric water heaters. Split the market among them, divide by 175, and the unprofitable aspects of water heater operations become rather apparent.

So one company reduces the number of its models from 175 to 12—"Simplifying the business was an absolute necessity if we were to continue in it on a sensible basis . . ."—the only thing it could do.

What circumstances led to such an absurd situation, anyway? In a nutshell, merely that the utilities prefer to go their separate ways regarding a matter in which they should obviously cooperate. From the technical and economic standpoints—and these ought to be the criteria—is there really a utility whose load characteristics or other considerations cannot be accommodated by a line of, say 12 water heaters that give good range and selectivity in wattage, tank size, and model? We think not.

Furthermore, we feel this problem of *standardization* goes beyond the particulars of water heaters. Industry leaders—again, utilities and manufacturers—ought to be thinking or doing something about it. Otherwise, we may wake up some morning to find some of our business "going up in smoke"—*or gas*.

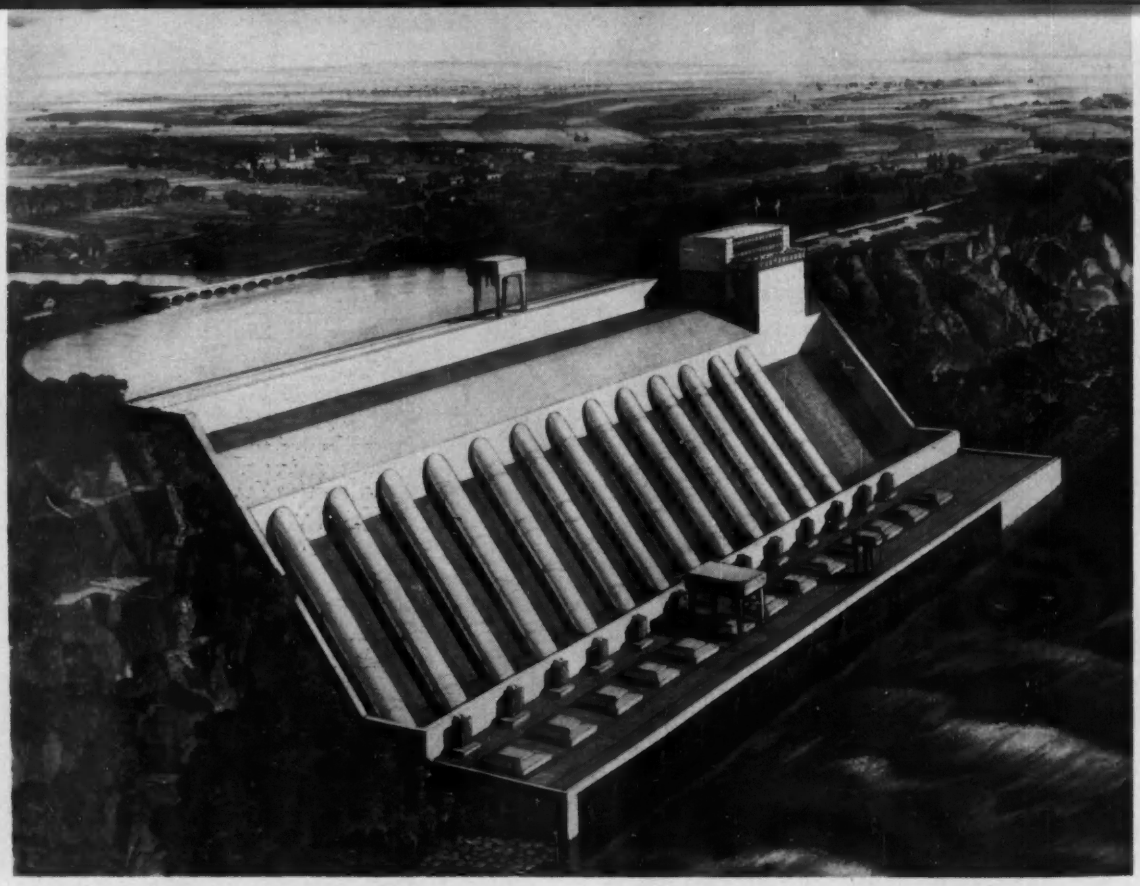
More Mechanization for Distribution

Paring the cost of the delivered kilowatt-hour is not so easy as it used to be. Efficiency of generation is rapidly approaching a peak. Transmission is scarcely less refined. It's in distribution that utility engineers today will find their biggest opportunities to make appreciable savings.

Conspicuous among these opportunities is more mechanization of distribution construction. The succession of electrical-mechanical-hydraulic booms, cranes, and mobile arms are the latest devices to offer opportunities in this area. Mounted on trucks or self-contained, they are highly mobile tools.

First cost of these and other mechanized tools is certainly greater than of old traditional construction devices. The cost of operating and maintaining mechanized tools, too, is likely to be higher. But their effectiveness, when utilized fully, is enormous, and the saving is in proportion.

Modern mechanization requires some very real reorganization of work procedures to be effective. And there must also be employee retraining. These changes will be disturbing to those who have become set in their ways and resistant to change. But to those adaptable enough to take advantages of it, mechanization means real savings. How important these savings can be will become more and more evident as coming years bring increased use and refinement of application.



N. Y. State Power Authority has proposed Lewiston Station for development of Niagara

The Niagara Fight: Will It End This Year?

An undercurrent of urgency has arisen recently which may finally resolve the six-year-old dispute over development of the river's 1,800,000-kw potential

Possibility of passage is strengthened by the narrowing of the dispute to one issue—preference

Niagara power development, the six-year controversy which ended last year in a Congressional deadlock, once again returns to the Congressional scene, but this time with a single major issue at stake—the preference clause.

This new simplification of a many-sided issue, added to a more urgent need for Niagara development than ever before, may lead to passage of the measure this year. Best bet is that the successful bill will propose construction, without the federal preference clause, by New York Power Authority.

There are several reasons for the greater sense of urgency which has arisen this year. Among them are:

- Niagara Mohawk Power Corp's loss of 365,000 kw caused by the rockslide last June which knocked out its Schoellkopf hydro plant.
- The resulting higher cost to NMP of importing power from Canada. Pres Earle J. Machold reports this "substantially increased cost of doing business" resulted in a drop of nearly $1 million in the utility's 1956 profits. Purchasing greater amounts of power from Canada and buying more coal to step up power output at steam stations to make up for Schoellkopf's loss caused the jump from four-tenths of a mill to 4.5 mills per kwhr in the cost of a large amount of NMP's power.
- The possibility that the area would lose numerous industries previously using Schoellkopf power.
- The continuing growth of Ontario. This could lead to the possibility that Ontario Hydro may eventually be forced to reduce or cease the sale of power to Niagara Mohawk to meet its own demands.
- The co-operative attitude of former opponents to the plan proposed by the Power Authority.

This year's simplification of the once-complicated dispute is reflected in the measures already in the Congressional hopper. The only point at issue is whether the state's municipalities and rural co-operatives shall receive priority in the allocation of Niagara's potential 1,800,000 kw.

The measure which seems to have the best chance for success was introduced in the Senate by New York Sens Irving M. Ives and

Jacob Javits (S-1037) and in the House by Rep William E. Miller (HR-4294).

Reflective of the new spirit of co-operation among the state's private utilities, New York Republicans, and the Power Authority, this "compromise" proposal would authorize the Power Authority, "pursuant to existing New York State law," to construct the $600-million project, but only if the federal-type preference were omitted.

730 Mw for 3 Companies

Under this plan, Niagara power, pooled with 200,000 kw from the Power Authority's proposed St. Lawrence project, would be tentatively allocated as follows: 445,000 kw to Niagara Mohawk, as replacement of losses sustained at the Schoellkopf plant; 730,000 kw to Niagara Mohawk, New York State Electric & Gas Corp, and Rochester Gas & Electric Corp, for rural and domestic consumers; 300,000 kw in anticipated demands for new national emergency defense plants; 250,000 kw for expansion of existing industries in the Niagara area; 150,000 kw to the states of Ohio and Pennsylvania and 125,000 kw to municipalities and rural electric co-operatives.

The Power Authority plan further provides that as the needs of co-ops and municipalities grow, a maximum of 200,000 kw could be withdrawn from the utility allocation of 730,000 kw and assigned to them.

Disunity Among Democrats

In contrast to the Republican unity within New York is the discord found among the Democrats. Rep Charles A. Buckley, chairman of the House Public Works Committee, has introduced a pro-preference bill in Congress. This bill and others introduced by Democrats are similar to last year's defeated Lehman bill, and have the backing of New York Gov Averell Harriman and other pro-federal power Democrats.

But Harriman's two appointees on the Power Authority, former Gov Charles Poletti and A. Thorne Hills, have indicated support of the anti-preference plan. Poletti has stated he would not "fight the compromise if that is all Congress will give us," although he favors inclusion of a preference clause. Hills echoed this opinion. He has pointed out that since the State Power Act provides for priority on power to domestic and rural users, the preference issue is not so important in New York as elsewhere.

The State Power Act provides that power development "shall be considered primarily as for the benefit of the people of the state as a whole and particularly the domestic and rural consumers to whom the power can economically be made available."

The Authority's three other members—Chairman Robert Moses, John E. Burton, and William Wilson, are on record as favoring large sales to industry and continuing substantial reliance on private utilities to service the domestic and rural customers. This, generally, was the marketing principle followed in the contract for St. Lawrence power which was recently signed by Niagara Mohawk, Reynolds Metals Co, and the Power Authority and approved by Gov Harriman.

State Preference Act Proposed

Meanwhile, the New York State legislature has received a bill which would carry out Harriman's proposal that the Power Authority give preference on Niagara power to state agencies and their subdivisions, cooperatives, and federal agencies.

Complicating the Niagara redevelopment issue this year, as in the past, is the dispute over Congress' authority to decide how development of Niagara should proceed.

The dispute centers around a reservation included in a 1950 treaty between Canada and the United States. This reservation, appended by the Senate, gives Congress the power to decide who should develop the project.

But the Power Authority contends that one agency, namely the Senate, has no right to set aside a previous action of the full Congress, which established the Federal Power Commission as the only body enabled to grant power licenses.

The Power Authority thus applied directly to FPC for a license last year. When FPC refused to act, claiming it had no jurisdiction over the Niagara issue, the Power Authority submitted the case to the Federal Court of Appeals. The case is still pending.

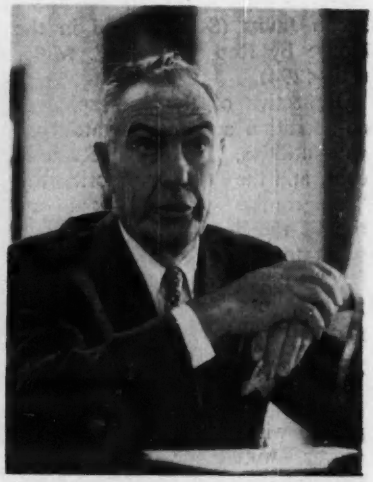
Moses: Persevering NYPA leader

Machold: Urges "compromise"

Harriman: Backs preference

"Our program cannot move . . . until one most important problem is solved—that of insurance. Quoted rates are astronomical."—Gale Freer, Rural Co-op Power Assn.

"We have been deeply concerned over monopolization of the atomic field by private utilities and associated groups."—Clyde Ellis, National Rural Electric Co-op Assn.



"Using natural uranium, fuel costs can be potentially obtained which are appreciably less than we now have."—W. C. MacInnes, Florida Nuclear Power Group.

Is the U. S. Atom Industry Healthy, or Does

Hearings by Joint Committee on Atomic Energy reveal mixed feelings. Some say two atom programs are needed —one domestic, one foreign

Congress has gotten its report on the status of the civilian atomic industry. Republicans think the infant industry is healthy and growing according to schedule. Democrats think it needs federally financed forced feeding.

On one thing both sides agreed: The international market should be the immediate prime consideration.

Thus, if anything has come out of the hearings just concluded before Congress' Joint Committee on Atomic Energy, it is, as Atomic Energy Commissioner Harold S. Vance told the committee, that this country needs two atomic power programs—one for domestic purposes and one for the international market.

Although these hearings were not aimed primarily at atomic power but rather the industry in general, atomic power was the key issue. The big fight over whether the government should build power reactors will come when JCAE holds hearings early in April on Sen Albert Gore's bill proposing the federal reactor program.

The Democrats, particularly Sens Gore (Tenn.) and Clinton P. Anderson (N. M.), and Rep Chet Holifield (Calif.), renewed their war with AEC Chairman Lewis L. Strauss.

Strauss told the committee the record of growth in the atomic energy industry in the past year is an "impressive account of the world leadership" to which it has attained. Particularly noteworthy, he added, was progress in the development of power producing nuclear reactors.

On the reactor program, AEC's Thomas E. Murray again was the only commissioner to disagree with Strauss. He again advocated federal construction of large power reactors, but at AEC installations to avoid the issue of federal versus private power.

Sen John O. Pastore (D-R. I.) then insisted that Strauss and the other commissioners be required to tell the committee just why Murray's idea couldn't be adopted. Commissioner Willard F. Libby, answering for AEC, said that Murray's proposal differs little from what the Commission proposes under its third-round invitation to industry to build reactor projects. And if the third round fails, Libby said, then AEC can turn to the "less desirable" course of federal construction. Murray's course "is less desirable because it recommends the less desirable course first."

I. The International Market

Many questions about the success or failure of the U. S. programs stem from failure to recognize differing needs of the U. S. and countries abroad, said Vance speaking for the Commission. "The plain fact of the matter is that we need two programs instead of one. We need one for ourselves and one for our foreign friends, each tailored to fit a different set of circumstances."

The Democrats, who agree on the importance of the foreign market, use this as bolstering their argument for federal construction of power reactors. This, they contend, is the quickest way to demonstrate and prove out large-scale plants for potential foreign buyers. Private industry is not doing the job fast enough, they maintain.

Not so, says Strauss. He claims the U. S. today is the only country exporting reactors. U. S. firms have contracted for or are negotiating at

"The aqueous homogeneous reactor appears to have real promise. We must recognize, however, that we are looking into the unknown." —Dr Shoupp, Pennsylvania P&L.

"Present plans of electric power companies in construction of nuclear power plants and in study of advanced reactor concepts comprise a comprehensive program. As opportunities develop, we believe our industry will take further steps to advance the technology and economics of nuclear power applications."—Elmer Lindseth, CEI.

It Need Federally Financed Forced Feeding?

least six power reactor contracts and about 13 research reactor contracts.

Gore, who had been to Japan in recent months, said the Japanese had decided to go to England for a large power reactor instead of buying a U. S. unit. Strauss claimed the latest information is that the Japanese have not committed themselves and will re-study U. S. offers.

Vance told the committee the major roadblock to opening up the huge potential foreign market for power reactors is not any lag in U. S. reactor technology but a matter of fuel. Since U. S. reactors are based largely on enriched uranium, foreign purchasers of American reactors would be dependent on this country for future fuel supplies, for chemical reprocessing of spent fuel elements, and for re-purchase of plutonium and other fission by-products.

The commissioner suggested that consideration be given to offering long-term guarantees to foreign countries to assure them of continuity of fuel supplies and services for the foreseeable life of a reactor.

II. Increased Costs

The Democrats hammered away at Strauss, particularly, and industry to a lesser extent, on reactor costs and completion dates. They wanted to know from Strauss what industry's response has been to his January third-round invitation.

The sharp increase in cost estimates for all types of reactors, the Democrats claim, gives further support for their argument that only the government can afford to build these initial power reactors.

Statements to the committee from various companies show that the increases are partially due to newness of the atomic power field, and to higher costs of materials and labor (EW, March 4, p 57).

Murray told the committee that increased costs have caused industry to come to the view that "it is premature today to believe that the economic merit of power reactors can be evaluated realistically." A program of government reactor construction, he says, would "substantially lessen the risk that private industry's plants will fail."

III. Government Help

The most outspoken industry support for the view that government financial assistance is needed came from Dr Chauncey Starr, general manager, atomic international div, and vice-president, North American Aviation, Inc.

Starr said the economics of the electric utility industry would not permit continuous support of the required national development. "It appears, therefore, that the support from the national government, through the Atomic Energy Commission, must inevitably continue for some years as it has in the past."

Suggestions that financial aid on fuel costs be worked out by AEC came from two utility men.

Willis Gale, chairman of Commonwealth Edison Co of Chicago, told the committee in a letter that realization of ultimate fuel cost based on maximum efficiency will not be accomplished for five or six years. During this period the reactor owner is likely to incur substantial excess costs. "These extra costs could serve as a serious deterrent to the undertaking of otherwise worthwhile projects," he said.

Gale suggested that AEC offer reduced fuel charges for nuclear fuel during the early years of a reactor's operation.

William Webster, Yankee Atomic Electric Co president, said fuel fabrication and chemical processing will be high-cost operations in first generation reactors.

"Accordingly, we believe the suggestion clearly warrants full examination that fuel fabrication costs and

SEN GORE WAVES FAMOUS ECAP ATOM AD AT LINDSETH (LOWER RIGHT)

reprocessing costs to first generation reactors should be reduced through government assistance, either directly or reduced charges at Commission facilities or indirectly by extending financial assistance or price guarantees to private fabrication and reprocessing facilities."

IV. Completion Schedules

The Democrats charge that the industry's progress is too slow, that completion dates on a number of projects have been pushed back as much as a year; that private industry can give no guarantee when a plant will begin operation. Questioning brought out:

1. **A delay of some months** for completion of the Yankee project; it's now fixed at 1960.
2. **A year's delay**—until 1961—on the Consumers Public Power District project.
3. **An undetermined situation** on the Pennsylvania Power & Light Co-Westinghouse Project. The company's schedule calls for determination in early 1958 whether an economically feasible aqueous homogeneous reactor—one of the toughest technologically to build—can be constructed for operation by 1962.

All other major projects appear to be coming along on schedule—but Murray and committee Democrats say these schedules won't be met.

V. Third-Round Invitation

Strauss' January third-round invitation to industry to come forward with reactor proposals was his answer to previous Democratic charges that he opposed speeding up the reactor program. It was also aimed at getting industry to take on projects covering the entire range of desirable reactor concepts.

He set a June 30, 1962, deadline for completion of proposed projects and called specifically for a natural uranium and aqueous homogeneous reactor in addition to any reactor of promising design. If industry does not come forward within a reasonable period of time, he said, then AEC would build at least two.

The hearing brought out the first definition of "reasonable time." Commissioner Libby told the committee it would be reasonable to give industry a year to work out proposals and still expect completion by the June, 1962, deadline.

As to the response to the invitation to date, the hearing disclosed this much:

On the types proposed, W. C. MacInnes, chairman of the Florida Nuclear Power Group said that his company is hoping to propose a natural uranium reactor of about 134-Mw capacity and costing about $55 million.

The Pennsylvania Power & Light Co-Westinghouse aqueous homogeneous reactor project may be sufficiently advanced within a year for inclusion under the third-round program. These two projects meet Strauss' third-round requirements as to types of reactors.

In addition these groups plan to seek inclusion, although the reactor types aren't among those specifically sought by AEC:

- Carolinas-Virginia Nuclear Power Associates, Inc for an unspecified type of reactor.
- The American Gas & Electric Service Co—lead group of Ohio Valley Utilities—for one of three possible advance-type reactors.
- Pacific Gas & Electric Co, either alone or with other California utilities, for an advanced boiling water reactor.

Elmer Lindseth, president of Cleveland Electric Illuminating Co and vice-chairman of the Edison Electric Institute committee on atomic power, told the committee that a number of companies besides these are studying advanced designs of nuclear power reactors.

His committee, he said, suggests it may be desirable for companies "to construct small-scale reactors of promising types without turbine generator facilities, at least initially."

This would not impair the technical contributions which can be derived from design, construction and operation of such a reactor, said Lindseth.

VI. Other Issues

The hearing disclosed existence of a report from Comptroller General Joseph Campbell criticizing the contract AEC wrote with Yankee Atomic Electric. Since this is the first contract written under the Power Reactor Demonstration Program, the report is regarded as significant for future negotiations.

The hearings were extended an extra day to have AEC explain its position on the contract. But no fight developed.

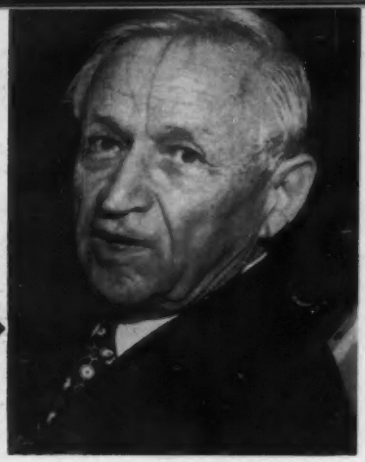
The committee majority showed definite interest in the request of Benjamin C. Sigal of the IUE that the committee investigate AEC on the charge of the union that the Commission acted illegally in granting a construction permit to Power Reactor Development Corp for a reactor project.

Rep Sterling Cole (R-N.Y.) asked Sigal why the union didn't go to court on the issue. Sigal replied that the courts would have to consider the case on the record of the current hearing underway before AEC on the PRDC project, and, furthermore, the courts would take too long.

Holifield asked Sigal if it were true that the unions had had trouble obtaining the aid of atomic scientists to testify for the unions against PRDC. Sigal said prospective witnesses for the unions "have been threatened by the Commission with reprisals if they testify contrary to the Commission's interests."

Holifield noted that if the committee held hearings on these matters, "AEC is not going to specify the issues."

EARL CHUDOFF: Charges utilities with brainwashing Interior; labels Ebasco "nerve center for propaganda"



CLARE HOFFMAN: Scathing reply denounces "utterly useless" report as attempt to "promote socialization" in nation

Chudoff Report Called "Utterly Useless"

Delayed report on last year's House hearings into alleged electric company attempts to influence Interior termed "one-sided" attack on private industry

Rep Earl Chudoff (D-Pa.), investigator of electric utilities, has issued the findings of last summer's hearings into the so-called "organized effort" of five Rocky Mountain power companies and Ebasco Service, Inc, to influence the Interior Department.

The Democratic majority report, described by dissenting Republican minority members as "utterly useless," contains findings which may surprise many utility people.

For instance, utilities backed, according to Chudoff, in reality an effort to "brainwash the new Interior Department officials."

Montana Power's Pres Jack Corette said of the Chudoff report: "I hope we never see the day when a Congressional committee can intimidate us into abandoning our right of free press, free speech, and free petition."

GOP Members Deride Report

Both the Chudoff report and the manner in which the preceding hearings were conducted drew a scathing response from the Republican minority members led by Rep Clare E. Hoffman (Mich.).

The report, they said, is part of the continuing attempt of the majority and its staff "to promote socialization as a national policy."

There is no need for a Congressional investigation of the content of promotional material unless there has been a violation of the postal regulations or the lobbying laws, they asserted.

A more appropriate subject for investigation, the minority suggested, was the majority's "irregularity and downright dictatorial misuse of the subpoena power . . . including the invasion of privileged intra-office correspondence."

Utility action criticized had consisted of joint sponsorship in 1953 by Arizona Public Service Co, Idaho Power Co, Montana Power Co, Public Service Co of Colorado, and Utah Power & Light Co, of a booklet, "The Federal Power Program—its background, growth, and consequences."

Charges Anti-Federal Bias

Chudoff also charged that "through its wholly owned subsidiary, Ebasco Services, Inc, the Electric Bond & Share Co maintains a nerve center for anti-public power and anti-federal power propaganda."

Chudoff calls for joint Congressional investigation of private electric utilities to determine whether "there is an organized effort" to influence the Administration and Congress; of the relationship between EB&S and Ebasco; and the manner in which electric companies charge the expenses of producing informational literature.

The minority pointed out that neither EB&S nor Ebasco owns stock in any U. S. electric utility company, and cannot therefore "control any such utility."

There "must be an end to the continual use of private industry as whipping boy by this subcommittee of which this irresponsible attack on Ebasco is another example," said the Republicans.

Why Not Probe Public Power?

They also suggested that if the investigators had been "entirely conscientious" they would have secured examples of the "vast amounts of materials released by proponents of public power" which have been presented to members of Congress and the Administration.

What the counsel for the subcommittee attempted to do with "The Federal Power Program" booklet, said the minority, "he might also have done with any of the pro-public power publications which had the same purpose, if the majority's aim had been fair and objective public service." But the attack was so "one-sided" that the majority even called as witnesses "two public power advocates, both registered lobbyists for public power interests, to try to disprove the facts in the booklet."

Majority Would Cut Tax Source

The minority members noted that investor-owned utilities in 1954 paid $1.4 billion in state, local and federal taxes. "And yet, the public power theorists would have this revenue-producing industry so hamstrung and whittled by non-taxpaying, federally-supported power facilities that the federal treasury would miss much of this important source of funds."

JEAN BAIR AND GLENN SORENSEN—manager and president, respectively, of Lincoln Service Corp—pose under their 20-mile-long line to LaBarge, (pop. 150)

Big Piney Gets Its Wish . . .

. . . as Lincoln Service Corp builds a 60-mile line to serve a sparsely populated area in Wyoming's Upper Green River Valley after fire wipes out diesel plant

Big Piney, Wyo. (pop. 206), is happy now. It has received central-station electricity at last.

Power flows into this southwestern Wyoming community by way of a 69-kv transmission line running from Frontier 60 miles away to the southwest.

The transmission line terminates at the Big Piney substation. From there, like spokes in a wheel, 380 miles of 14.4/24.9-kv distribution lines radiate to the communities of Pinedale (pop. 770), LaBarge (pop. 150), Daniel (pop. 100), and Boulder (pop. 65).

Ranchers Were Discouraged

Until a year ago, prosperous ranchers of Lincoln and Sublette counties had almost resigned themselves to an enduring absence of central station electric service. Various surveys into this 3,132-sq-mi Upper Green River Valley area had been run. But all were discouraging. Distances appeared too great, and customers too few. Even governmental surveys ended with no further action.

Trouble Hits Big Piney

Three days after Christmas in 1954, trouble struck Big Piney. A fire wiped out the isolated diesel-driven electric generating plant of Griggs Power & Light Co, which supplied the community. Prompt replacement of this generating plant was beyond company resources. Help had to come from outside.

Lincoln Service Corp, headquartered in Frontier, raced to the rescue. It installed portable diesel-driven units to restore electric service to Big Piney after a power blackout of only one day.

Lincoln Buys Grigg's Facilities

Lincoln then began acquiring the remaining assets of Griggs P&L. Then Glenn E. Sorensen, president of Lincoln, said his company would build a 69-kv transmission line to Big Piney from Lincoln's 5,500-kw steam plant at Frontier. This has been done and power rates now are lower than those previously in effect.

Big Piney attributes achievement of its dream to Sorensen's faith in the future of this large valley, which teems with oil and gas activity.

Lincoln Service Corp is owned by Lincoln Corp of New York City. The latter corporation is owned by descendants of Mahlon S. Kemmerer, for whom the town of Kemmerer, Wyo., was named. Load and feasibility studies of the area, and design of the electric facilities, were made by C. H. Hoper & Co, utilities engineers of Denver, Colo. This company also worked out the lower rates which Big Piney and neighboring towns are enjoying.

Winners Named . . .

. . . in appliance contest: West Penn, Florida Power, Boston Ed, and SMUD

General Electric Co's Appliance and Television Receiver Division has announced the winners in its annual competition among utilities for promotion of major electric appliances. Announcement was made at the company's recent Utility Executive Conference in Louisville.

The contest had four categories for contestants: (1) Non-merchandising utilities with more than 300,000 residential meters, (2) non-merchandising utilities with less than 300,000 residential meters, (3) merchandising utilities (no size breakdown), and (4) municipal utility districts.

Winner in the first category was West Penn Power Corp; R. G. MacDonald, vice-president, received the award for the company. In the second classification Florida Power Corp walked off with the honors. Shirley Gracy, FPC's sales vice president, took the award. In the third group, Dale Washburn, vice-president of Boston Edison Co, accepted the honors for his company. In the fourth category, for municipals, Sacramento Municipal Utility District won. SMUD's Carl Ritchey accepted the award.

$500 Prize Awarded

All winners received a bronze plaque, a check for $500, and two all-expenses-paid trips to Europe.

George Bogard, manager of utility relations for GE, presented the awards. He cited the winners for the contributions they've made to their communities and local businesses. "They've been guiding forces in helping their customers to live better electrically," he said.

Judges for the contest were Fischer Black, publisher and editor of Electrical World; P. B. Garrett, editor-in-chief, Electric Light & Power; and C. W. Leihy, editor of Electrical West, a McGraw-Hill magazine in California.

EW to Sponsor Future Contests

Bogard also announced that Electrical World plans to take over from General Electric, and sponsor the annual contest in the future.

Adjusting the Pay Scale

Experienced engineers have watched with growing dismay as starting salaries for engineering graduates have climbed higher and higher. Too often, no adjustment was made to their own salaries to reflect their experience and skill.

Now the Seattle (Wash.) Professional Engineering Employees' Assn has proposed to Boeing Airplane Co that salaries of established engineers be adjusted yearly to compensate for increases in starting salaries for young engineers.

Under the association's plan, starting salaries would be evaluated each August to determine what percentage increase has developed. This percentage then would be applied to established engineers' salaries, raising them to a level that the company would have to pay "in the free market."

The association also wants salaries of established engineers increased to make up for the shrinking differential that has developed over recent years between salaries for established and starting engineers.

Fly Ash at Wilson Dam

Tennessee Valley Authority plans to use home-collected fly ash in hundreds of thousands of cubic yards of concrete needed for a new lock now being built at Wilson Dam. TVA expects to obtain: (1) A stronger concrete after the first few months, as fly ash gains strength for years, (2) greater watertightness of the concrete, (3) greater workability of the concrete as fly ash concrete flows easily around reinforcing bars and into close spaces, and (4) increased resistance to attacks by chemicals in the river.

The expected saving in cost will reflect the greater ease with which the concrete is put in place, as well as the saving in concrete displaced by fly ash.

Changing Times

An era is ending in Philadelphia. Harold G. Mason, chief of the city's street lighting division predicts that the last gas light will be gone by 1960. About 10,496 today light one-third of the city's streets and alleys. The old gas veterans will be replaced by new-fangled electric lights.

Fireworks in North Dakota

North Dakota's House of Representatives, which has plodded along without much fuss through most of its current session, let loose with some fireworks recently when Rep Lloyd Esterby of Williams County sought passage of a bill that would prohibit utilities—specifically Montana-Dakota Utilities Co—from selling electric or gas appliances.

Rep Esterby said this constituted "unfair competition." Rep Ralph Beede, Grant Sioux, said, "I've had complaints from my district that when a private dealer sold an appliance, people had trouble in getting the utility to hook it up, but they didn't when the utility sold the appliance."

But Rep Howard Doherty of Mercer-Oliver-Dunn labeled the bill "one of the most confounded pieces of legislation I've ever seen." He called the measure "grudge" legislation and a threat to free enterprise. The House voted to kill the bill.

Health of the Atom

Atomic Energy Commissioner Lewis L. Strauss is confident that the atomic industry is healthy. At recent hearings of the Joint Committee on Atomic Energy, he covered the whole atom field from isotopes to manpower needs. He cited industry figures to show that in 1957 alone purely industrial spending on the atom will run over $500 million, and that in the reactor field, business had trebled in 1956.

He backed up this optimistic picture with these estimates: (1) In 1958, about $270 million will be spent on civilian power and military reactors, (2) during 1956, the industry began building, or received contracts for, 59 new reactors—including 29 power reactors, and 30 research and test reactors, and (3) there are now enough firms to fabricate fuel elements. The AEC has withdrawn from making these units for private purposes, he said.

Hot Oven . . .

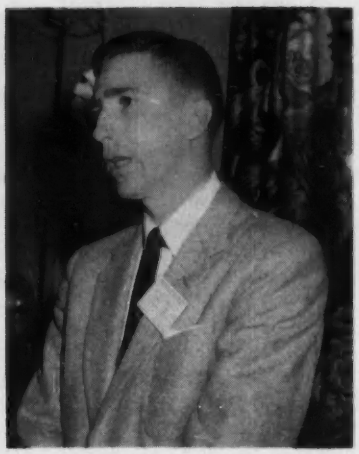
During a recent TV commercial at Twin Falls, N. Y., Barbara Neilson was extolling the virtues of an electric range. She reached for the oven door, recoiled, fell to the floor. The camera shifted quickly to another scene. The station later announced that she apparently had received "a slight electrical shock" but didn't have to go to the hospital for treatment.

For the Folks Back Home

In a joint resolution introduced in the House of Representatives, James W. Trimble (D-Ark.) points out that because of the drought and electric power requirements, the levels of Norfolk Dam and Bull Shoals Dam reservoirs were so low that "recreation and resort facilities of the lakes were rendered nearly useless." He proposes that the Corps of Engineers study feasibility of building a standby steam plant to exorcise this threat in the future.

PROTECTION—Design

W. S. PETERSON, APPA president, makes keynote address. Listening are H. D. Miller, general manager, City Utilities, Springfield, Mo., and Alex Radin, APPA



J. H. EXUM describes Jackson, Tenn., underground residential distribution

Explains Public Power's Higher Customer Use

APPA President W. S. Peterson credits lower rates than those of private companies. Aerial cable use and buried primaries are engineering topics

Lower rates account for the greater residential use on the systems of publicly owned utilities than on those of private companies, W. S. Peterson, president, told the American Public Power Association at its Feb. 14-15 meeting at Springfield, Mo. Residential use on the publicly owned systems was 3,523, on private ones 2,392 kwhr per customer, he told APPA's first Engineering and Operations Workshop.

"Our private competitors," he said, "try to indicate that this advantage is one that we gain through tax exemptions which they do not have. But the facts are that publicly owned enterprises frequently carry some equally heavy burdens affecting their rates that private companies do not have, such as, extensive financing of system construction out of revenues, free service to the community, or transfer of funds to local governments."

Aerial Cable Adopted

The Elizabethton, Tenn., Electric System's new overhead network for the downtown area has 13 225-kva network transformers with medium-duty network protectors on steel structures spanning alleys parallel to the main street, said John F. Meagher, manager. The network is fed by three feeders, and secondaries are 350-MCM copper. Aerial cable was used for the primaries and secondaries.

Transite Duct Used

J. H. Exum, chief engineer, said that the Jackson, Tenn., Electric Department had downtown distribution systems in residential areas whose primaries were chiefly of the direct buried type installed in Transite duct. Transformers of the overhead type are semi-buried in 4-ft sewer-tile sections. Operation has been good, he said.

The combined gas turbine-steam cycle gives the designer a new tool for increasing power plant efficiencies, said F. L. McAuley, Westinghouse Electric Corp. Gains with the combined cycle, he said, can be more than those obtained with reheat and almost as much as can be obtained with supercritical pressures; yet the combined cycle can be applied in plants of 200,000 kw and below, said McAuley, where the supercritical pressures cannot be justified.

Nashville Electric Service is in the midst of a program of modernization of street lighting, said E. E. Parks. Cost to the people of Nashville, he said, will be less than $2 per person per year.

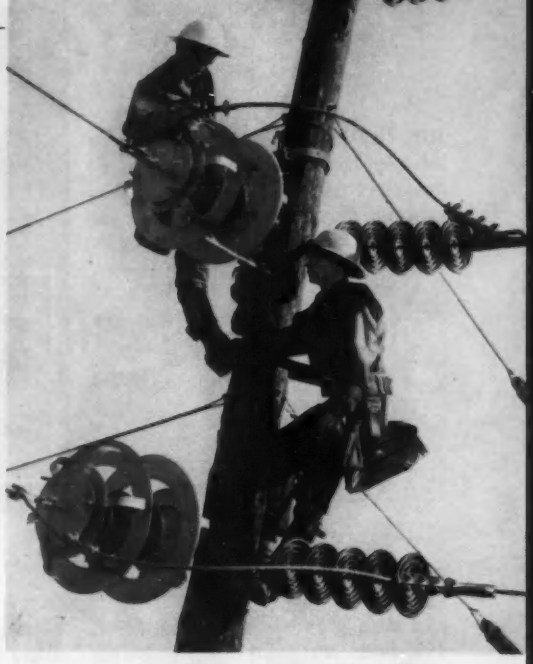
Auto accident frequency of the Los Angeles Department of Water and Power was reduced from 11.42 per 100,000 miles in 1946 to 4.22 in 1956, said Clayton M. Allen, engineer in charge of the general plant division. Driver testing, education and training, handled in a way that created and maintained employee interest, were given credit.

U. S. May Present 8 Papers in 1958 CIGRE Meeting

The United States plans to participate in the 17th biennial session of the International Conference on Large Electric Systems (CIGRE) June 4-14, 1958, in Paris, France. As one of 41 participants, the U. S. will be permitted to present up to eight technical papers dealing with achievements in high-voltage power generation and transmission.

Selection of subjects and authors will be made by the U. S. Tech-Subcommittee, chairmanned by C. C. W. Franklin, Consolidated Edison Co of New York Inc.

U. S. National Committee officers for 1957 are: Philip Sporn, (American Gas & Electric) president; H. L. Melvin (Ebasco Services) vice-president; and I. W. Gross (AG&E) secretary-treasurer.



Cougnard Deionisers: New Mystery in Lightning Protection

Philadelphia Electric, with first experimental installation in America of deionisers for complete protection of an entire transmission line, claims this device produces "amazing improvement"

H. N. EKVALL, Senior Engineer, Research and Development Department, Philadelphia Electric Co, Philadelphia, Pa.

Curiosity about a radically new but simple form of lightning protection led Philadelphia Electric Co to make the first experimental installation in America of Cougnard Deionisers for complete protection of an entire transmission line. Operation of the deionisers during the past year has produced an amazing improvement in the lightning performance of a 16-mi 33-kv line.

Philadelphia Electric's interest was first aroused by claims that lines and equipment in France, Africa, and Canada were operating trouble-free at various voltage ratings after installation of 10,000 deionisers. Of great economic significance were claims that these devices made overhead ground wires and counterpoises unnecessary. So, with no known way of testing deionisers in the laboratory, a field trial was made.

The optimism which fostered this experiment has been strengthened by the very favorable results obtained last year on this and other experimental lines. Nevertheless, further operating experience is needed to demonstrate conclusively the protective value of this scheme.

The late Jerome Cougnard invented the deioniser in 1946; yet how it performs is still a mystery. Cougnard's theoretical explanation is difficult to comprehend in the light of conventional thinking and still remains to be proved or disproved.

Cougnard theorized that lightning is created when sufficiently high voltage is induced in clouds by the galactic magnetic field cutting across them at 2,000 mi per sec. The lightning stroke ionizes the atmosphere and some of the ionized air is blown free of the stroke by the wind. These clouds of ionized air are called "vortical lightning" or, more commonly, "ball lightning." On coming in contact with a power line, the cloud of ionized gas attaches itself to the conductors and is propelled along them by the wind.

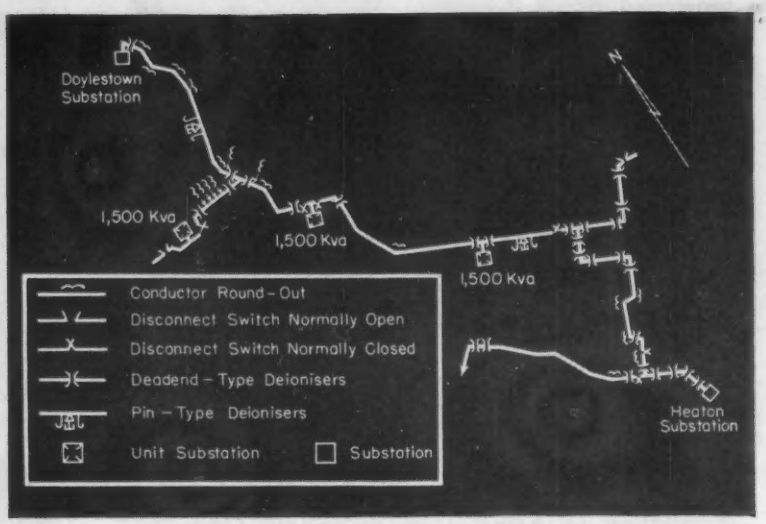
Cougnard recognized that moving gas has inertia. Therefore when a cloud of ionized gas travelling along the conductor comes to a sharp turn, it tends to keep moving in a straight line. If, for example, this occurs at a deadend string of insulators, the ionized gas passing across them may cause power flashover and subsequent line tripping. Cougnard reasoned that (1) the cloud of ionized gas might be prevented from passing over the insulator string by use of a barrier placed in its path, or (2) it might be guided around a bend in the line by use of "round-out" jumpers. Philadelphia Electric employs both these methods on its experimental line.

Cougnard designed the deionisers to act as barriers. When the cloud of ionized gas strikes the deionisers it explodes with a loud noise, giving off glow light. In this process of deionization the cloud emits high frequency waves which pass harmlessly to ground without causing power sparkover of the device.

Finally, Cougnard believed that damage to power lines and equipment is caused by power surge voltages created by 60-cps sparkover initiated primarily by vortical lightning. The direct stroke, he asserted, is an infrequent cause of line flashover but is attracted to certain sections where iron ore deposits or other special geological conditions are prominent. He suggested deionisers or lightning rods for protection against wood-pole splintering by direct strokes.

These theories are incorporated in the design of the deadend and pin-type deionisers. The 33-kv deadend-type device is composed of 24-in.-diam parallel galvanized steel discs spaced 9½ in. apart. Each main disc is supported by an intermediate disc connected to an

Based on a paper presented by the author before the Transmission and Distribution Committee, Pennsylvania Electric Association.



THIS 16-MI 33-KV wood-pole line was selected for the trial installation of deionisers because it had been consistently the poorest performer for Philadelphia Electric during storms

end disc with six adjusting bolts. The bolts are used for paralleling the main discs during installation in the insulator string. The end discs have ball-and-socket hardware fittings of the same length as the insulators, thus permitting direct insertion in the string.

In the trial installation two of the five insulator units in the string were removed and the deioniser discs inserted. This gave the desired spacing of 9½ in. between main discs and left the over-all string length and conductor sag unchanged. At all deioniser locations line jumpers were bent at right angles to the conductors to prevent the vortical lightning from passing the deioniser.

The 33-kv pin-type deioniser consists of an inverted U-shaped galvanized steel hood 26-in. long, 13-in. wide, and 10-in. deep. It clamps to the top of a 45-kv pin-type insulator. Two barrier plates extending above the hood are slotted partially at the bottom to permit access of the line conductor which is clamped to the top surface of the hood. A grounded U-shaped box, 6½-in. long, 7-in. wide, and 4½-in. high, is fastened to the pin just underneath the insulator. Minimum air clearance between hood and box is about 8½ in.

In both types one element is grounded and the other energized at line voltage. Their capacitance to ground is about 10 micromicrofarads. The deadend type acts as a barrier to vortical lightning coming along the line from one direction. Consequently, where a conductor makes a right-angle bend, two deionisers are required. The pin-type device, however, presents a barrier to lightning from either direction as well as above. This type is generally used at a vertical tap-off point to a transformer.

In May 1956, Philadelphia Electric installed 81 deadend-type deionisers at right-angle turns, air break switches, and the ends of a 3-phase, solidly grounded neutral, 33-kv line. This line was selected because it had been consistently the poorest performer during lightning storms. Most of the line runs through sparsely settled rolling country about 10 mi north of Philadelphia.

A departure from the desirable location of deionisers had to be made in the case of air break sectionalizing switches, which are of the swinging-gate design with vertical phase configuration. It was feared that upon opening of the switch its jumpers might contact the grounded disc of the deadend type deionisers. For this reason the devices were placed on the poles adjacent to rather than directly on the switch poles.

At line angles from 90 to 150-deg round-out jumpers were installed instead of deionisers. The jumpers guide the vortical lightning along the line and thus avoid flashovers.

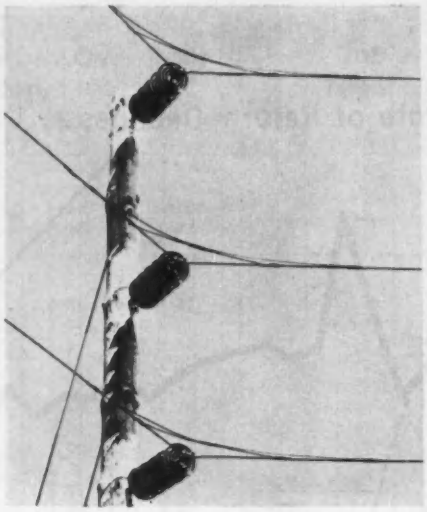
Two sets of pin-type deionisers, installed in August at points where lightning had caused a concentration of splintering, are expected to prevent direct stroke damage to poles in the vicinity.

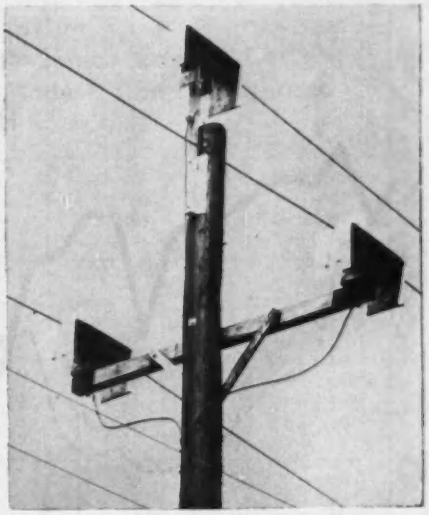
At all locations the deionisers were grounded to a 10-ft driven rod with no attempt made to obtain lower ground resistance. Rod ground resistance varied widely but was generally high—50 to 100 ohms. Connections were also made between the down leads to the common primary-secondary neutral wire, were present. Existing lightning arresters were not removed from the substations, although they were claimed unnecessary.

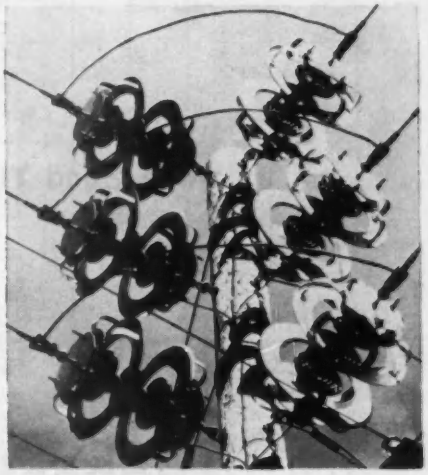
The effectiveness of deioniser lightning protection may be demonstrated by comparing the performance of Philadelphia Electric's experimental line with other 33-kv lines in the vicinity. During 1951-55 the test line averaged 6.8 trippings per year. But in 1956 the line had just one tripping before and one after installation of the deionisers. In the same year six of the seven other 33-kv lines in the vicinity had as many or more lightning trippings than their five-year average.

The only lightning tripping on the deioniser line occurred Sept. 1, as a result of flashover of the top phase deioniser on a corner pole. Apparently, lightning struck simultaneously at the television antennae on a house about 150 ft beyond this corner pole.

The damage to the deioniser con-







1 ROUND-OUT JUMPERS are installed instead of deionisers at line angles of 90-150 deg. The jumpers are expected to guide the vortical or "ball" lightning along the line, thus avoiding flashovers

2 PIN-TYPE DEIONISERS are used where lightning had caused concentration of splintering. They are said to prevent direct stroke damage by presenting a barrier to lightning from three directions

3 DEADEND-TYPE DEIONISERS act as a barrier to "ball" lightning as it travels along the line from one direction. Therefore two deionisers are used on each phase at right-angle bends in the line

sisted of a few burn marks on the main discs. They had become out of parallel, for some unknown reason, thereby decreasing clearance at the top of the discs and reducing the flashover strength. The discs of the other five deionisers on this corner pole remained essentially parallel in alignment.

This article would be incomplete if it did not report three other trippings of the line during 1956. Two of these were caused by squirrels. On June 19, a squirrel apparently flipped his tail across the top phase deioniser on a corner pole. The resulting power arc tripped the circuit.

The squirrel's mate experienced the same fate one week later. The two disasters wiped out the prospective family of squirrels, and no further squirrel trouble has occurred.

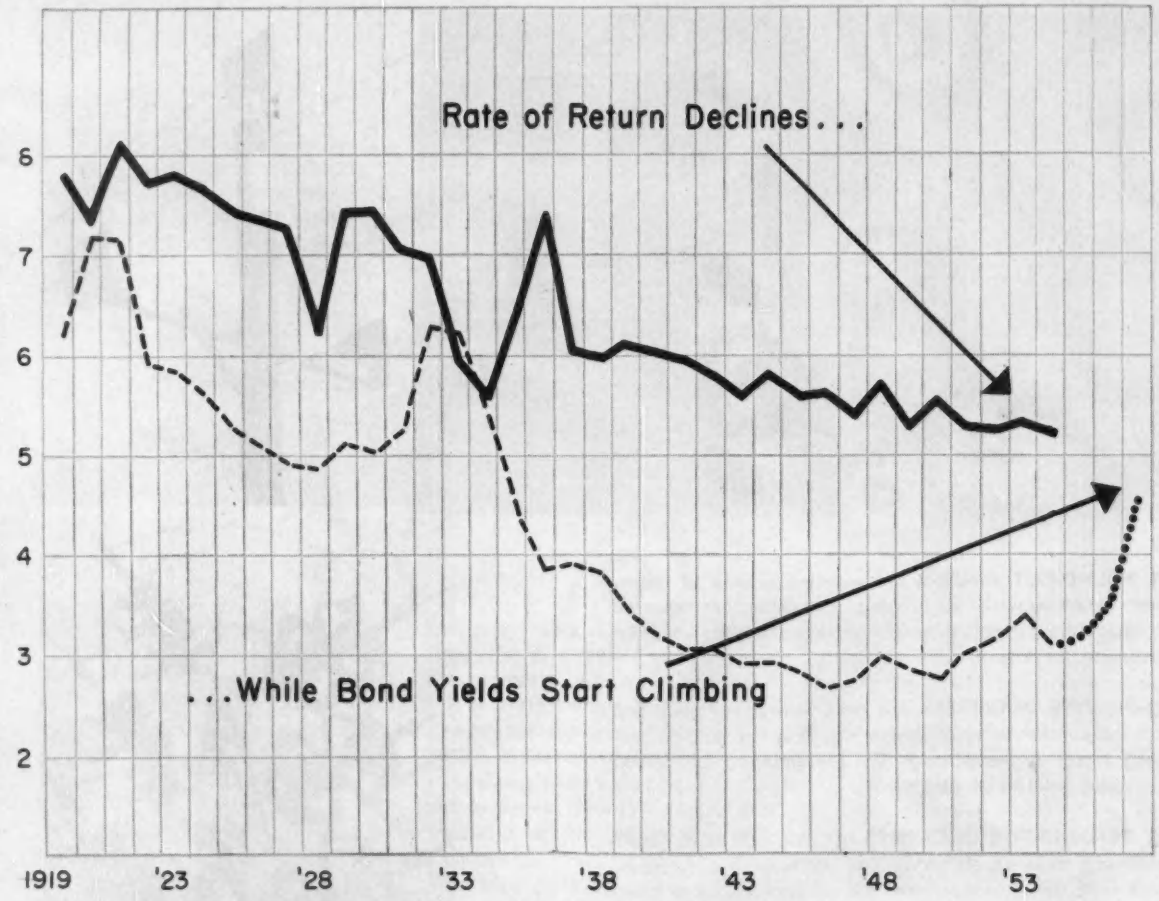
The third and last line tripping took place during clear weather at 1 AM on Oct. 4. Its cause has not been determined, but a deioniser was found to have been burned.

Reports from other users indicate no line interruptions after installation. Some state that deionisers have been seen to operate with a glow accompanied by an explosive noise, as had been claimed previously by Cougnard. Except for an unusually bright flash along with a strong explosive report on Aug. 13, at the Doylestown end of the line, no other indication of deioniser activity has been directly observed on this line. There was no line tripping or damage to the deionisers at that time.

On other systems, in the vicinity of the French Alps, ball lightning has been observed to travel on lines for distances up to 4 mi. These travelling clouds of ionized gases are said to be about 10 ft long and have greatest density of ionization adjacent to the conductor. Probably the ionization a short distance from the conductor is too weak to establish a conducting path between phases of a 3-phase circuit.

In view of these amazingly effective results, Philadelphia Electric plans to continue its observations of the line's operating experience. This will be supplemented with field and laboratory investigations to determine the operating principle on which Cougnard Deionisers function.

Other companies which may be considering making a trial installation of Cougnard Deionisers may find 1957 a good year in which to obtain operating experience. A severe lightning season is expected as the result of sun spot activity which should reach a maximum this year.



Higher Interest Rates Must Be

If regulatory bodies fail to correctly measure the increased cost of capital and its function in a capital-attracting return, investors may start by-passing utility stocks.

The job for management? Develop proof of what return is needed, particularly with today's high interest rates

CHARLES TATHAM, Public Utility Analyst, Bache & Co, New York, N. Y.

The substantial increase in the cost of senior capital can pose a serious problem to utilities unless it is promptly recognized in the regulatory process of determining fair return. This problem will lie not in the area of increased difficulty in obtaining bond or preferred stock money but rather in the impact of this higher cost on residual earnings for common stock. The effect of this on the industry's ability to raise new equity capital demands careful watching.

Generally, it seems present higher interest rates are a good thing for our economy because they mean peoples' savings will receive a more adequate rate of compensation. The supplier of senior capital has been the "forgotten man" for years.

For this reason, it is difficult to sympathize with those who express concern at current "high" interest rates or who criticize the Administration for "damage" that "tight money" is said to be doing to small business, home builders, and others. It seems to me the so-called "tight money policy" is less a positive action on the part of fiscal authorities than a refraining from a positive action of deliberately augmenting the money supply, ie, deliberately furthering inflation. A planned policy of monetary inflation—dollar cheapening—should hardly be welcomed by those interested in maintaining flow and productivity of capital or those who invest savings in economic enter-

Table I—Excess of Return Over Debt Costs Show Stability

	Average Rate of Return (state commissions) a	Moody's Average Bond Yields	Excess of Return Over Interest Rate
1919	7.81%	6.21%	1.60%
1921	8.12	7.17	0.95
1923	7.83	5.84	1.99
1925	7.50	5.29	2.21
1927	7.30	4.96	2.34
1929	7.50	5.14	2.36
1931	7.21	5.27	1.94
1933	5.96	6.25	(0.29)
1935	6.42	4.43	1.99
1937	6.07	3.93	2.14
1939	6.17	3.48	2.69
1941	6.00	3.11	2.89
1943	5.63	2.99	2.64
1945	5.64	2.89	2.75
1947	5.48	2.78	2.70
1949	5.35	2.90	2.45
1951	5.86	3.09	2.77
1953	5.90	3.45	2.45
1954	5.80	3.15	2.65
Average Entire Period	6.50	4.33	2.17
Average 1919–28	7.51	5.90	1.61
Average 1929–38	6.67	4.95	1.72
Average 1939–48	5.80	3.03	2.77
Average 1949–54	5.80	3.10	2.70

a* From "Rate of Return Allowed in Public Utility Rate Cases," Arthur Anderson & Co C. Tatham 1/12/57

Table II—Senior Capital Costs, Though Modest, Can't be Ignored

		Present Capital
Long Term Debt	$50,000	3.2 % = $1,600
Preferred Stock	15,000	4.2 = 630
Common Equity	35,000	11.0 = 3,850
	$100,000	$6,080
Rate of Return		6.08%
(a) Present Debt	$50,000	3.2 % = $1,600
New Debt	10,000	4.6 = 460
	$60,000	$2,060
Cost Rate		3.43%
		20% Growth
Long Term Debt	$60,000	3.43% = $2,060 (a)
Preferred Stock	18,000	4.44 = 798 (b)
Common Equity	42,000	12.00 = 5,040
	$120,000	$7,898
Rate of Return		6.56%
(b) Present Prf	$15,000	4.2 % = $630
New Prf	3,000	5.6 = 168
		$798
Cost Rate		4.44%

Recognized in Utility Rate of Return

prise. And yet, either this, or else a real decline in our rate of economic growth, appears to offer the only reason for expecting lower interest rates over the intermediate future.

If this reasoning is correct, it is difficult to agree with a financial writer's recent comment in a leading newspaper that a "cheerful note in the outlook is that tight money probably will be easier before the year's end."

In regard to home building, the Wall Street Journal recently stated this consensus of prominent bankers and economists: Mortgage money will be available in sufficient quantity to finance 1 to 1.1 million new homes this year; and it is big demand for borrowings, not any engineered shortage of money, that has made credit tight.

Actually, of course, interest rates are not high, except as compared with deliberately maintained low rates of the inflationary Forties.* During this time, interest rates, as measured by Moody's Composite Average Utility Bond Yields, averaged 2.95%, and during the same decade the Consumer Price Index rose from 59.9 to 102.8, or by 71.5%. Prior to 1940, the Index remained virtually unchanged since 1932. Since 1950 it has risen from 102.8 in 1950 to 114.5 in 1955, or 11.4%, but the indicated rate of inflation has apparently been sharply cut. Whether or not serious inflation necessarily accompanies a deliberate policy of easy money is perhaps not proved, but the evidence appears persuasive.

Table I shows the average allowed rate of return developed in electric utility rate cases by state public service commissions over the 36-year period 1919-54. The figures are from a study by Arthur Andersen & Co and cover an aggregate of 190 cases. The middle column shows the trend of interest rates as measured by Moody's Composite Average of yields on public utility bonds. The right hand column shows the excess of average overall rate of return over average interest rate.

Over the entire period, average permitted fair rate of return was 6.5%, and average interest rate was 4.33%, indicating an average excess

*Low interest rates in this 1940-50 period may have also reflected in part a relatively inactive demand for capital funds.

of return over the cost of debt capital of 2.17%.*

Decline in rate of return found reasonable by regulatory commissions is evident in the table. It is even more clearly shown on the chart. By and large, this closely paralleled the decline in interest rates, at least until 1946. Interest rates halted their long decline then and began to rise although the increase was moderate until 1955. Average rate of return, however, continued to decline through 1954.

Since 1939, excess of return over debt capital costs showed stability, averaging 2.74%. Earlier, the excess appears to have been much lower. But keep in mind that in that period the prevalent practice was to use a fair value rate base, which is a figure much higher than would be that for a net investment rate base as computed, and widely used, today. Had return been related to net investment during the pre-1938 period, rate of return would have been higher, with a commensurate excess over the then prevailing interest rate.

At the bottom of Table I the data shown are averaged by decades, which shows permitted rate of return declined from well over 7% prior to 1928 to less than 6% in recent years. While this drop accompanied the downward trend in interest rates, an important factor in both is the maturing of the industry and its evolution from what was considered a hazardous, untested business to a position of prime regard in the investment field. Somewhat superficially this appears to indicate a decline in the risk element in the electric power business. However, I am not convinced that the risk element has in fact been materially reduced. I think it is questionable whether this is adequately recognized by today's cost rates for senior capital.

The continued uptrend in utility bond yields brought the average interest rate to 3.22% in 1955 and the sharp acceleration in this rise brought yields to 3.93% by December 1956. More recently yields averaging about 4.6% have been necessary to sell utility bond.

Comprehensive data on allowed rates of return during 1955-56 have not yet been compiled. Available evidence indiates little, if any, rise during 1955 and probably the early part of 1956. More recently, some commissions have recognized higher costs of senior capital. Presumably this will be increasingly taken into account as conditions justify it.

Money Market Higher

For example, the Florida Commission in a recent order granting a rate increase to Peninsular Telephone Co pointed out "today's money market is admittedly higher than it has been for many years and there is little prospect of cheaper interest in the immediately foreseeable future." The allowed rate increase was estimated to provide a 7.08% return on a net investment rate base, which may be compared with a Dec. 1952 order that a 6.5% return was then fair and reasonable. In its latest order, the commission said current and prospective capital costs should be modified by consideration of the actual requirements of existing senior capital and that new bond money cost should be averaged in with interest rates on debt.

The incremental effect of current higher interest rates depends on a company's expansion rate and volume of required new financing. It is less serious than may be commonly imagined. For example, Table II shows the effect on a company with a fairly typical capital structure of an increase in cost of debt capital from 3.2% (existing) to 4.6% (new money) and an increase in the cost of preferred stock from 4.2% to 5.6%, in conjunction with a 20% increase in total capital. In this example, I have also assumed that the "cost" of common stock capital rises from 11% to 12%. As shown, the over-all rate of return necessary to meet these "costs" rises from 6.08% to 6.56%, or by 7.9%. I should emphasize that these figures are used solely for illustration, not as indicative of "cost" levels that might be found in a rate of return determination. The impact of higher senior capital costs is relatively modest and will only be felt over a period of time. Nevertheless, it is very real and cannot be ignored in the regulatory process.

For this reason, a ruling such as Mississippi Public Service Commission's in the Southern Bell Telephone case is disturbing to investors. The commission concluded that, based largely on cost of capital testimony of a commission witness, a fair rate of return was 4.96% to 5.08% when related to a net investment rate base. It is difficult to avoid thinking that such a conclusion must indicate a complete lack of understanding of the correct measure of the cost of capital and its function in a capital-attracting return.

Power to regulate embraces the power to destroy as well as power to protect, and a heavy burden of responsibility falls upon state and federal commissions to allow rates of return adequate to attract the vast amounts of capital the utility industry will need. An equally serious responsibility falls upon company managements to develop evidence of what the necessary capital-attracting return is, particularly in times such as the present, when interest rates have been rising sharply and the effect of this on the cost of common stock capital is as yet largely unknown.

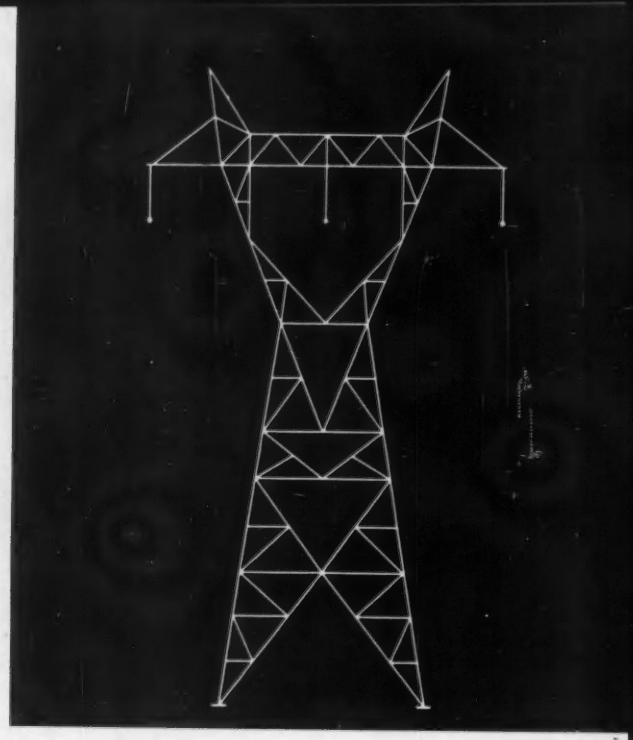
I question the validity of averaging in historic cost of existing senior securities when computing cost of capital as an element of return requirement. Fair rate of return and cost of capital, which is one of its elements, are concerned primarily with the future. And, in the case of an expanding company faced with a continuing need for new capital, it is current and foreseeable costs that enter into a capital-attracting return. Even in the case of a company that is not seeking new funds, a sole or even major reliance on past capital costs would be unfair to investors if current capital costs were materially higher. And it would be economically unfeasible if

(Continued on page 178)

* This is not strictly correct, since average bond yields are based on market prices and cost of debt capital to a company would be higher, due to expenses involved in a bond sale and the fact that new issues are usually priced to yield somewhat more than the average going market rate. For my purposes, however, language used above is reasonably appropriate.

A Special Report

Designing Tomorrow's Transmission



DAN BRAYMER, Assistant to the Editor

Tomorrow's transmission is being designed today. New voltages, new structures, new construction materials, and new concepts are being tried out to meet the stepped-up need for lower-cost, higher-capacity transmission on expanding power systems.

Some of these design departures are contained in the pages of the following special report. Here is told how:

- Use of bundled conductors on a 345-kv line was the basis for cutting tower weight and cost 50%. As it is unlikely both conductors will break at once, tower strength requirements could be, and were, reduced. A unique tower resulted.
- A 230-kv line without dead ends was the outgrowth of a study showing that most conductor and support failures occur at dead ends. Result is a so-called "flexible" line design.
- Lighter-weight, lower-cost steel towers for a 230-kv line grew out of the calculated risk of accepting lower insulation level and the possibility of a higher flashover rate.

These designs are not capricious. They are carefully thought-out steps backed by study and research. Experience with these innovations will be the springboard from which to launch further improvements in transmission technology.

Truly these designs are the fore-runners of tomorrow's transmission.

Narrow-Base Steel Towers Designed for New 345-Kv Line

Conductor bundle allows modification of broken wire requirements and permits 50% cut in tower weight. Reduced reactance boost capability...p 92

Design 230-Kv Wood H-Frame Line for St. Lawrence

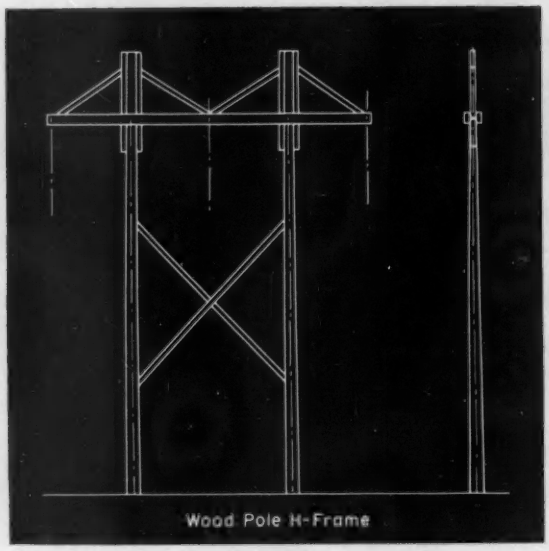
Eliminate all dead end structures and resort to spar construction for 71-mile line of 200 Mva capability. High reliability a prime requisite....p 96

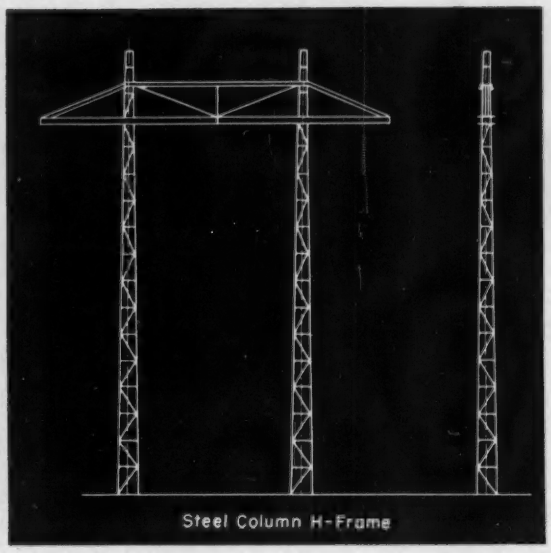
Uses 69-Kv Section to Obtain 161-Kv Single Pole Line Data

Build section of single-pole structures using wishbone-type crossarm to secure data on a design that would conserve expensive right-of-way....p 98

230-Kv Tower Design Requires 25% Less Steel

Reduced insulation level and higher flashover rate accepted on USBR line to permit use of smaller lighter towers for heavy loading condition.....p 100





Evolution of structure designs was from wood H-frames to steel columns and

Narrow-Base Steel Towers

Resort to bundle conductors reduces tower strength requirements by permitting modification of allowance for broken wire conditions

Phase spacing reduced by restraining the center phase conductors

For equal RI performance, comparison shows bundle conductors give lower reactance, greater transmission capability, wider range of design flexibility

Insulation requirements call for 18 5¾ by 10 in suspension insulators per string

A. C. VEROCK, Overhead Line Design Engineer and

R. G. PATRICK, Professional Engineer, Commonwealth Associates Inc, Jackson, Mich.

Light-weight steel towers, bundled-conductors, and restrained middle-phase insulator strings are features of a new 345-kv, single-circuit line design now being developed for construction in midwest heavy loading areas.

Evolved in a step-by-step process from wood H-frame design, a new narrow-base tower construction shows decided advantage in providing a rugged yet economical support for twin-bundle 795- or 945-MCM ACSR conductor. Restrained midddle-phase insulator strings add further to the economical features of the design by reducing crossarm length and tower body requirements.

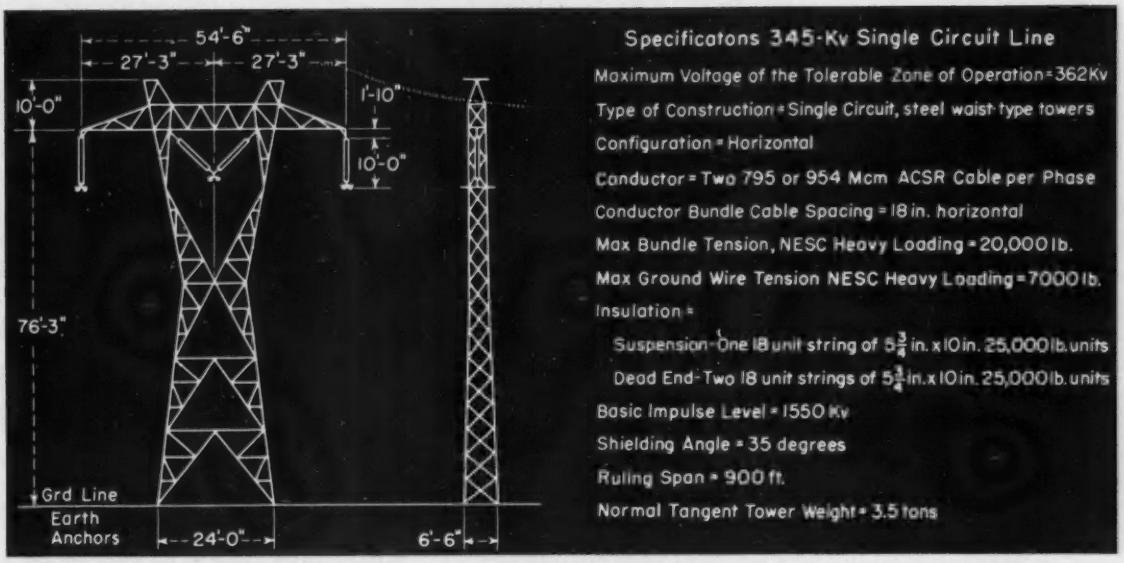
Bases for the design were determined following extensive studies of available information concerning conductors, insulation, and clearances for extra-high-voltage transmission. These studies led to other investigations of radio influence and sleet melting and consideration of new structural material such as plastics and laminated woods.

Basic Requirements Studied

Insulation was determined from factors of overvoltages caused by neutral shift, generator and transformer regulation, and switching surges occurring during line-to-ground fault conditions. A safety factor was then applied to the overvoltage factor to provide for anticipated atmospheric conditions and insulator contamination. This resulted in a requirement of 17 standard 5¾ in. by 10 in. suspension units. One unit was added to allow for the possibility of a defective one.

The flashover charactertistics of the 18 units are: 60 cps wet, 705 kv; critical impulse, 1,585 kv. The impulse flashover strength is eight times the phase-to-neutral voltage and is considerably higher than on 138-kv lines with proven performance.

Over 40 combinations of EHV conductors were compared on the bases of radio influence characteristics, surge impedance loading, resistance, reactance, and mechanical loading behavior. Conductors considered were from 636 MCM ACSR to 1.75 in. 1,414 MCM expanded ACSR. Various combinations of the smaller conductors were tried as bundles of two or three cables spaced between 14 and 20 in. All were compared with regard to variations in phase spacings and the effect this would have on radio influence and other electrical considerations.


54'-6"
27'-3"
27'-3"
10'-0"
1'-10"
10'-0"
76'-3"
Grd Line
Earth Anchors
24'-0"
6'-6"
Specificatons 345-Kv Single Circuit Line
Maximum Voltage of the Tolerable Zone of Operation = 362Kv
Type of Construction = Single Circuit, steel waist-type towers
Configuration = Horizontal
Conductor = Two 795 or 954 Mcm ACSR Cable per Phase
Conductor Bundle Cable Spacing = 18 in. horizontal
Max Bundle Tension, NESC Heavy Loading = 20,000 lb.
Max Ground Wire Tension NESC Heavy Loading = 7000 lb.
Insulation =
Suspension-One 18 unit string of 5¾ in. x 10 in. 25,000 lb. units
Dead End-Two 18 unit strings of 5¾ in. x 10 in. 25,000 lb. units
Basic Impulse Level = 1550 Kv
Shielding Angle = 35 degrees
Ruling Span = 900 ft.
Normal Tangent Tower Weight = 3.5 tons

thence to waist-type narrow-base towers. Bundle conductors cut weight 50%

Designed for New 345-Kv Line

Radio influence charactertistic comparisons were based on ratios of critical corona voltage to maximum operating voltage. A relative criterion was based on present lines having acceptable RI performance and from published results of experience in this country and abroad. This method is believed satisfactory for a comparative study although it appears that further investigation is needed in this field before an accurate and entitrely acceptable criterion of radio influence is established.

Fig 1 represents RI characteristics by graphically comparing the ratios of critical corona voltage to maximum operating voltage for several EHV conductors considered for nominal 345-kv service. Favorable performance is indicated with twin 795 or 954-MCM ACSR bundled conductors as well as single conductor 1,414-MCM expanded ACSR. The twin-bundle 636-MCM ACSR and single 1,275-MCM expanded ACSR conductors indicate questionable RI characteristics in this comparison.

Other factors, such as the number of outer-layer cable strands and phase spacings, also affect RI as

Bundled and expanded single conductors compared for equivalent RI:

Bundled conductors would . . .

1. Reduce line reactance approximately 25%
2. Give greater transmission capability resulting from lower reactance and resistance
3. Afford a wider range of flexibility in the design to obtain acceptable RI characteristics
4. Facilitate handling with the use of smaller hardware and accessories
5. Permit the design of lighter supporting structures

Expanded single conductors would result in...

1. Lower material cost per phase
2. Better characteristics for conductor sleet melting
3. Shorter structures because of less sag for the same total tension per phase
4. Lighter ice and wind loadings
5. No midspan cable spacers

EHV conductors compared on the bases of

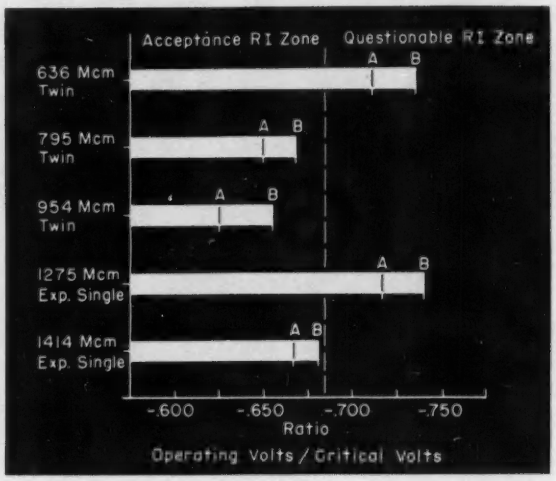


FIG 1—RADIO INFLUENCE indicated by the ratio of operating voltage to critical voltage. A relative criterion is indicated by the broken line. Variations between "A" and "B" show the effect of conductor stranding and phase spacing

indicated by "A" and "B" on Fig 1. No allowances were made for conductor aging with accompanying reductions in RI because the degree of reduction resulting from this phenomenon is not precisely known.

Fig 2 and 3 show comparisons of inductive reactance and surge impedance loading for both bundled and single conductors. The lower reactance of the bundled conductors is reflected in the comparison of surge impedance loading which is an indication of line capability. This amounts to as much as a 25% advantage for bundled conductors.

Bundled Conductors Selected

A comparison of bundled and expanded single conductors was made on the basis of equivalent RI performance. Findings are shown in an accompanying tabulation.

The effect of variations in bundle spacing between 14 and 20 in. was studied. Decreasing the bundle width 2 in. reduces radio influence approximately 1½% and increases the line reactance by a like amount. Bundle spacing of either 16 or 18 in. was considered adequate for radio influence and a spacing of 18 in. was selected for corona shielding and mechanical reasons. Suitable resilient type midspan spacers may be required, subject to further investigation, to maintain bundle spacing and to prevent the cables from wrapping under ice and fault conditions.

Narrow Base Towers Developed

The fundamental design of H-frame structures was used as the basis for a steel structure to provide a horizontal phase configuration and two overhead ground wires. Analysis of steel structures indicated that the waist type of tower would be more economical than a parallel-sided steel H-frame. Wood pole H-frames were considered, but the use of maximum sizes of poles and timbers appeared to offer relatively small economic advantage for the spacings and clearance requirements of 345 kv in heavy loading areas.

The principle of the narrow base and flexibility of the wood pole H-frame was retained in the steel tower design to reduce weight. This is possible because of the inherent strength characteristic of bundled conductors, permitting modification of an allowance for broken wire conditions, as it may be assumed that both cables will not be broken at the same time. The line tension of a broken bundle cable would be absorbed by the intact cable picking up tension stress. Added longitudinal and torsional strength is therefore not necessary. A saving of 50% in structure costs results.

Maximum tensions under NESC heavy loading conditions of 10,000 lb per cable—approximately ultimate—are contemplated, giving a total load of 20,000 lb per bundled conductor.

Other materials including fiberglass, plastics, concrete, aluminum, and laminated woods appear to offer advantages for future development of structures for EHV lines. However, these developments do not appear to be ready for application at this time.

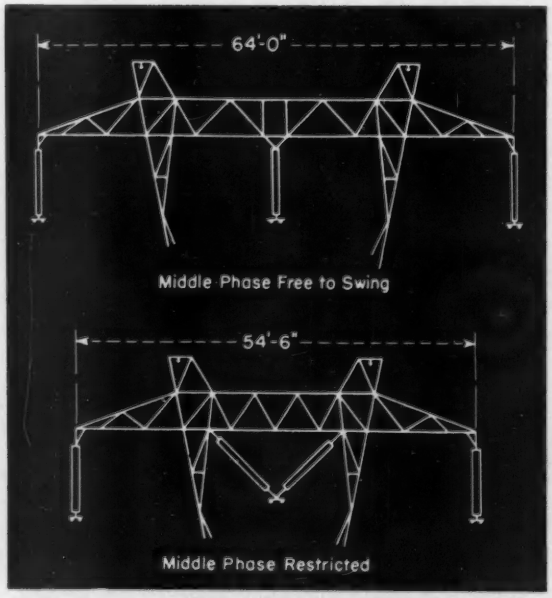


FIG 4—RESTRAINED MIDDLE PHASE insulator string reduces structure width about 10 ft on 345 kv steel tower design with 8½ ft conductor-to-tower clearance

Middle Phase Restrained

Phase clearances were determined from the combined spacings required by insulator deflection, minimum conductor-to-structure clearances, and structure width. Minimum tower arm length would be 64 ft, with 8½-ft conductor-to-tower clearance if the center insulator string were free to swing.

By restraining the middle phase, the tower arm length may be reduced to 54 ft as shown in Fig 4. This saved matereial and resulted in a lighter structure.

The application of an 18-unit insulator string to

RI characteristics, inductive reactance and surge impedance loading

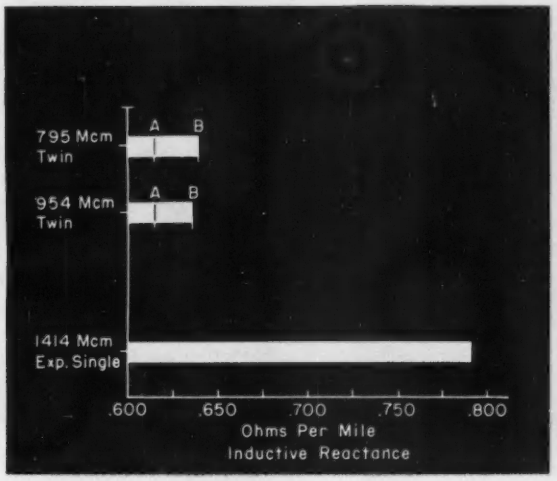


FIG 2—INDUCTIVE REACTANCE is less with twin bundled conductors than it is with equivalent single conductors of the expanded type. Variations between "A" and "B" show the effect of conductor stranding and phase spacing

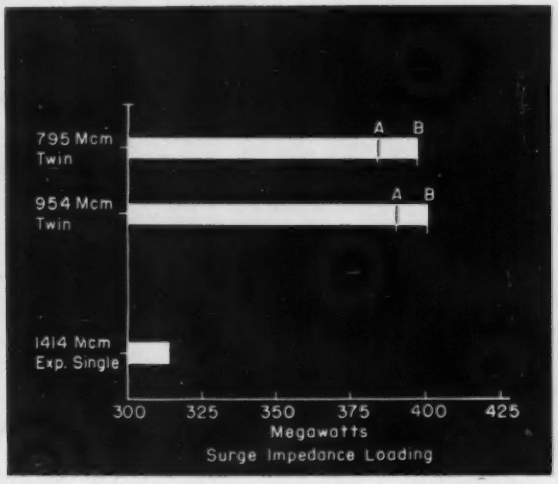


FIG 3—SURGE IMPEDANCE LOADING is considerably greater for bundled conductors than for expanded single conductors of equivalent size. Variations between "A" and "B" show the effect of conductor stranding and phase spacing

form a "V" was selected in favor of other methods to restrain the middle phase. The outer phases are left free to swing because of the relatively smaller saving that could be obtained from restraining them.

The expected lightning performance of this design is between 0.5 and 1.0 outage per 100 miles per year with a shield angle of approximately 35 deg from two ground wires and a ground resistance of 10 oms or less. Outages from flashovers caused by steep wave front impulse waves are anticipated but rarely because tower height is a direct factor in this consideration. And the structure height with this single circuit design will be greater than present 138-kv double-circuit steel towers with proven performance.

Important Factors Established for the 345-kv Design

1. Single conductor 1,414 MCM expanded ACSR and twin bundle 795 MCM and 954 MCM ACSR have satisfactory RI characteristics for 345-kv operation
2. Increased phase spacing decreases radio influence
3. The use of bundled conductors decreases reactance and increases transmission capability
4. Use of bundled conductors permits modified broken wire requirements and an accompanying 50% reduction in tower weight
5. Estimated installed costs of twin conductors is approximately 5% greater than those for single conductor
6. Wood H-frame structures for 345 kv show relatively small economic advantage because of pole height and timber requirements in heavy loading areas
7. Developments in such materials as plastics and laminated woods show promise in EHV application
8. EHV structures designed with low effective height and two ground wires offer good lightning performance characteristics
9. Restrained insulator strings represent an economy by saving on width requirements and structure weight

Design 230-Kv Wood H-Frame Line for

Line without dead-end structures is based on "flexible" design using spar-type wood H-frames. Reliability is prime requisite

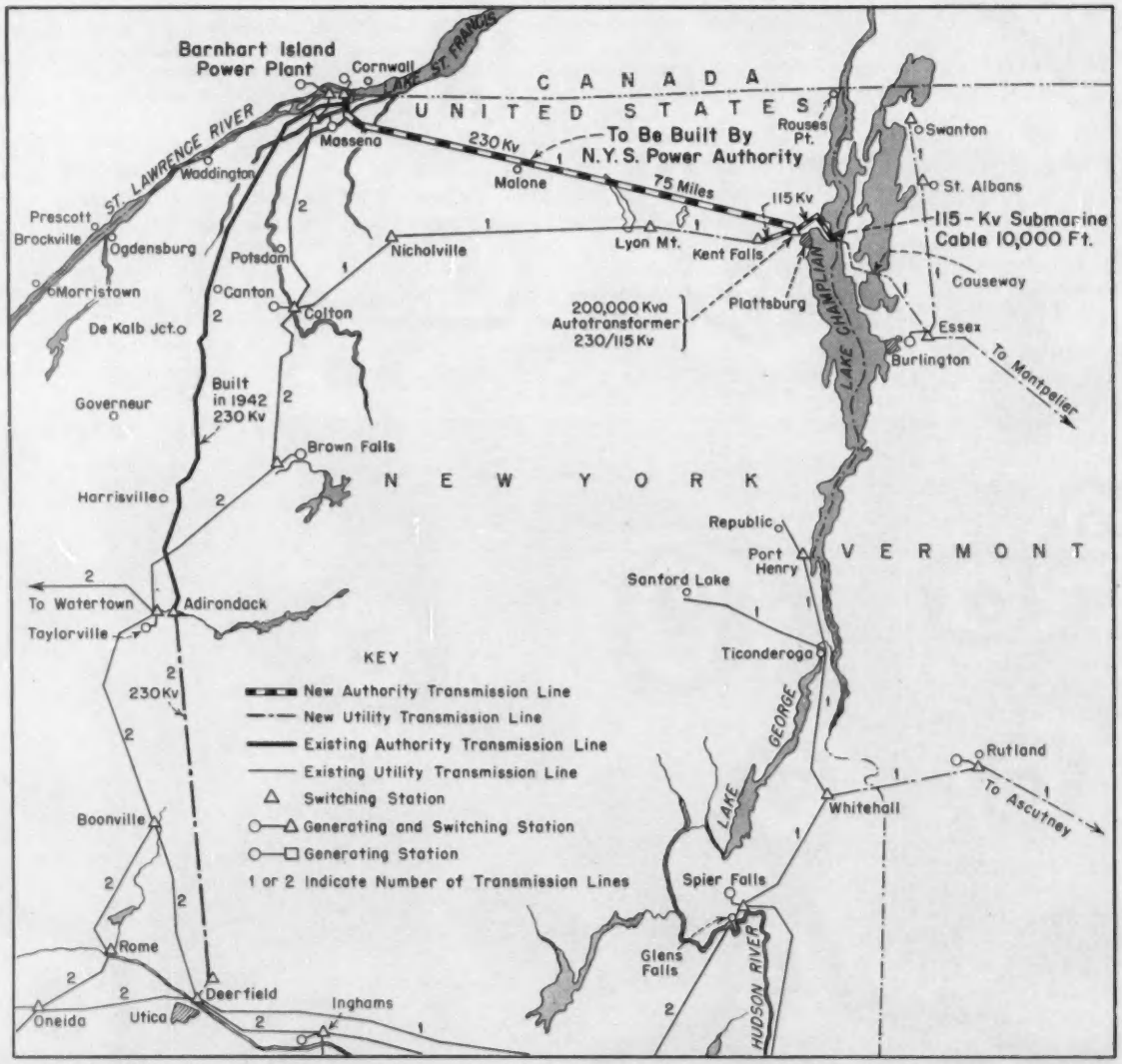
R. E. MORAN, Electrical Engineer, Uhl, Hall & Rich, Engineers* Boston, Mass.

The Power Authority of the State of New York has set April 1 for the start of construction on a single-circuit, largely wood-pole, 230-kv transmission line for marketing power developed on the St. Lawrence River. The Authority has received three applications for this power for which there are no transmission facilities.

Applicants for this power are the State of Vermont, the City of Plattsburgh, N. Y., and the United States Air Force for its Strategic Air Command base at Plattsburgh. Engineers of private utilities serving northern New York have cooperated with the Authority in network analyzer studies. On the basis of these and other studies, the Authority has embarked on a cooperative plan for transmission to Plattsburgh and Vermont.

This plan calls for a 230-kv line about 71 miles long. A substation will be built at Plattsburgh for stepping down to 115 and 45 kv. Transmission lines will be raised by the Authority of the State of Vermont, the Air Force, and the Kents Falls substation, the last for interconnection with the New York

*Partnership affiliate of Chas. T. Main, Inc.



TWO 230 KV LINES will carry power from St Lawrence Project into New York State. Construction of Barnhart to Plattsburg 71 mile line will start April 1. Line from Messena to Adirondack substation near Taylorville was built in 1942

St. Lawrence

State Electric & Gas Corporation.

The AF line will be at 46 kv, the others at 115 kv. Plattsburgh's 115-kv line will serve its city-owned electric system from the Authority's substation. Interconnections will supply secondary service during a 230-kv outage.

Interconnections Planned

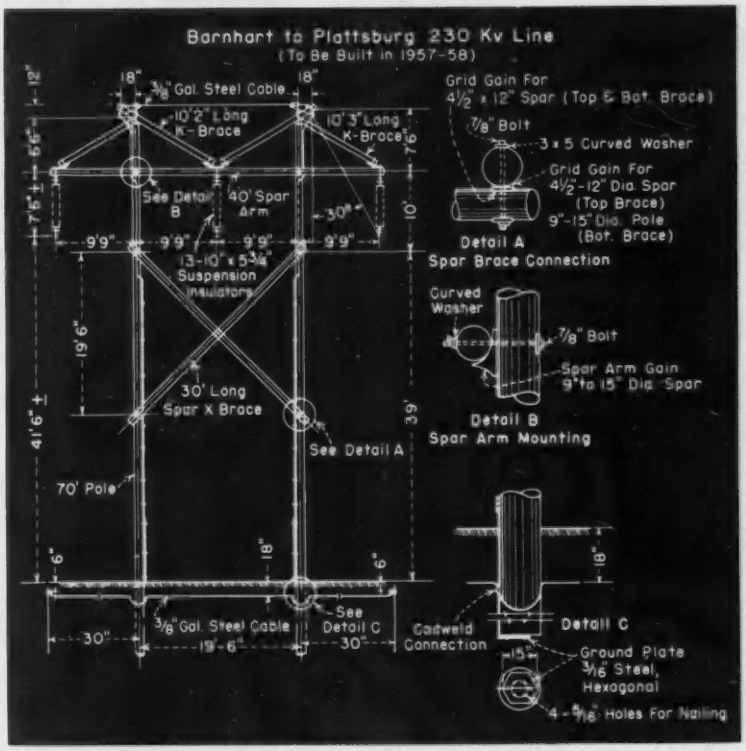
Besides that at Kents Falls, interconnections will be established between Niagara Mohawk Power Corp and the State of Vermont; Rutland, Vt.; and Whitehall, N. Y.; and between Bennington, Vt., and North Troy, N. Y. St. Lawrence power transmitted over the interconnections will be introduced into the utility systems through two existing Authority 230-kv lines at the new Authority 230-kv Adirondack substation. From there, it will be wheeled over the interconnected systems.

For a line across Lake Champlain, Cumberland Head, N. Y., to Grande Isle, Vt., a 10,000-ft section of submarine cable will be laid in 200 ft of water. About 73 weeks have been allowed for completion of the 71-mile, 230-kv line by September 1958. Clearing of the right-of-way, begun last October, has been finished, and the chemical treatment of stumps and uncut brush should be finished by October.

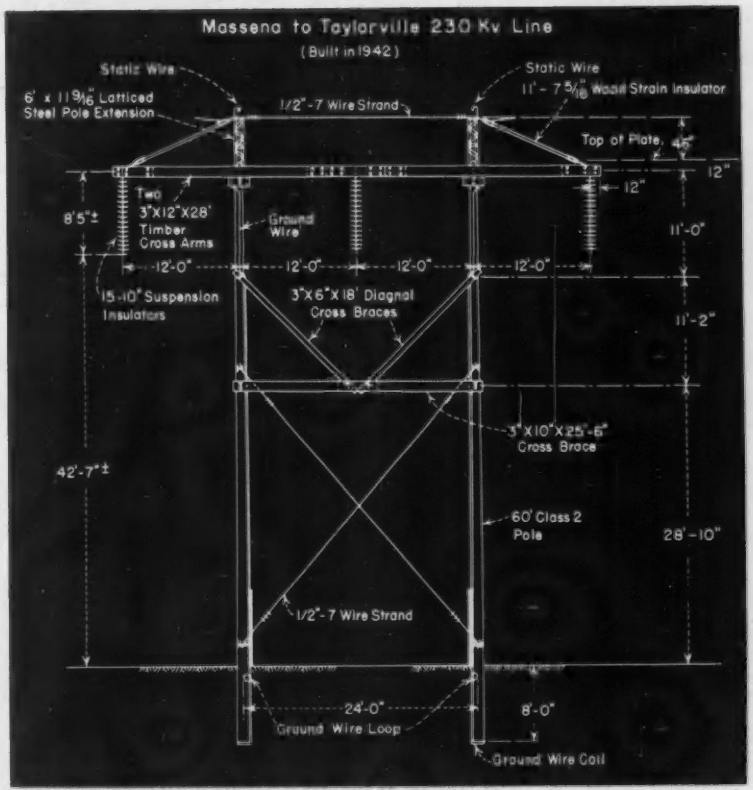
To Step Down to 115 Kv

The Barnhart Island-Plattsburgh line will have a rated capability of 200 Mva, and at Plattsburgh an autotransformer of that rating will step down the voltage to 115 kv. All switching will be at the 115-kv level. The autotransformer's differential protection will be maintained by Plattsburgh's 115-kv power circuit breakers and by high-speed carrier relaying to the Barnhart Island 230-kv switchyard.

The autotransformer will be a single, 3-phase unit rated for step down from 230 to 121 kv with a tertiary winding brought out and rated 13.2 kv. This winding will be a voltage source for a bank of 24,000-kvar of static capacitors, as well as for station service power. An automatic under-load tap-changing mechanism will permit variations


Barnhart to Plattsburg 230 Kv Line
(To Be Built in 1957-58)
3/8" Gal. Steel Cable
10'2" Long K-Brace
10'3" Long K-Brace
See Detail B
40' Spar Arm
30°
13-10" x 5 3/4" Suspension Insulators
30' Long Spar X Brace
See Detail A
70' Pole
3/8" Gal. Steel Cable
See Detail C
Grid Gain For 4 1/2" x 12" Spar (Top & Bot. Brace)
7/8" Bolt
3 x 5 Curved Washer
Grid Gain For 4 1/2"-12" Dia. Spar (Top Brace)
9"-15" Dia. Pole (Bot. Brace)
Detail A
Spar Brace Connection
Curved Washer
7/8" Bolt
Spar Arm Gain 9" to 15" Dia. Spar
Detail B
Spar Arm Mounting
Gadweld Connection
Detail C
Ground Plate 3/16" Steel, Hexagonal
4 - 5/8" Holes For Nailing

NEW PLATTSBURG 230 kv line will have no dead-end structures. "Flexible" design using spar arms and braces was selected. See 1942 design below



OLD TAYLORVILLE LINE built in 1942 for 230 kv but operated at 115 kv is being modified; will carry St Lawrence power at 230 kv to Adirondack

and automatic adjustment of the system voltages while maintaining a substation voltage regulation within 5%. The autotransformer will be of the forced-oil, forced-air-cooled design, having a BIL of 825 kv for the high-voltage winding and bushings.

Design of the Barnhart-Plattsburg 230 kv line was dictated by two basic considerations:

1. This single circuit will be the only source of supply for the 200 Mva step-down autotransformer at Plattsburg, and the primary supply for the Plattsburg area. Hence a high degree of reliability is essential.

2. Economic considerations precluded use of steel tower construction. Terrain is such that advantage is gained by use of tall, braced structures to permit longer spans.

The terrain suggested a structure design for withstanding heavy transverse forces and which permits longer spans than does the less expensive unbraced structure. Pole lengths will vary from 60 to 95 ft, and most of the structures will be made of 70 to 75 ft poles. By keeping a minimum ground clearance of 32 ft, except for a small portion of the line, an average span of 635 ft was obtained. For longer spans, maximum 1,450 ft, a special four-pole structure was designed to maintain the safety factor of 4 under heavy transverse loading conditions.

Some Steel Needed

Another basic feature of the line is elimination of all dead-end structures in favor of the so-called "flexible" design. Study of conductor and insulator failures showed most of them occur at dead-end structures. It is anticipated that the flexible design adopted will provide a greater degree of reliability.

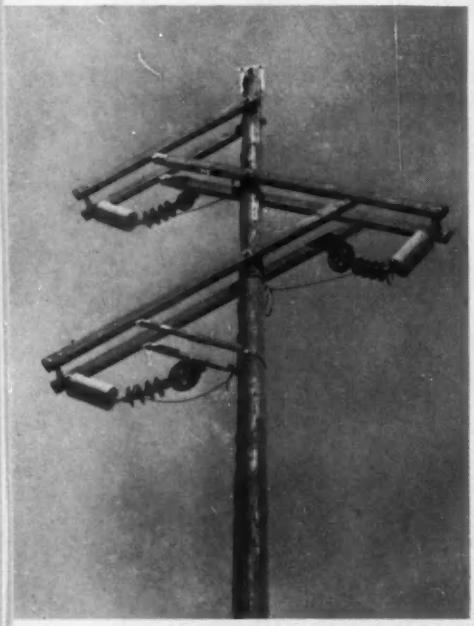
Basic H-frame structures will be entirely of round members. Connections have been designed for malleable iron fittings which will secure enough strength to transfer forces at these points. Connection points will need only a single bolt, and that at right angles to the line's transverse forces. Line hardware will be ungrounded to take advantage of the insulating properties of wood members. Very large, curved washers at connection points will provide a low-resistance contact and guard against burning poles.

In the congested area near the Barnhart Island switchyard there will be some steel-tower construction. Double-circuit steel towers will be installed for the first mile south of the switchyard to allow for installation of a second line.

The first mile south of the switchyard has an 1,800-ft crossing of the south channel of the St. Lawrence River, a crossing over an existing double-circuit, 115-kv transmission line, and a crossing of the long Sault Canel of the St. Lawrence Seaway, now under construction by the U. S. Corps of Engineers.

The line design seeks the maximum reliability attainable in modern transmission practice. Two overhead ground wires, providing a 30 deg protective angle, will prevent direct strokes to the phase conductors. Line insulation will prevent direct lightning strokes (100,000 amp) from flashing over by providing a minimum insulation level of thirteen 5¾ by 10 in. insulators plus 9 ft 9 in. of wood or 5.8 ft of air and reducing pole footing resistance to less than 20 ohms.

Galvanized iron plates, fixed to pole bottoms, will reduce impedance to ground for the high frequency of a lightning surge. Ground resistance will be further diminished by ground rods and a radial counterpoise connected to the structure down leads. This insulation will yield a wide margin of protection for power frequency and harmonics of power frequency over voltages caused by switching surges and ground faults.



CONCRETE WEIGHTS simulate future 161-kv conditions on 69-kv line

◀ Uses 69-Kv Section to

L. A. POTTER, Manager, Transmission and Distribution, Salt River Power District, Phoenix, Ariz.

Transmission at 161 kv may be carried on single-pole structures having a wishbone-type crossarm the Salt River Power District has found. Anticipating right-of-way problems, the District built near Phoenix an experimental line section of this type which has been in service at 69 kv since last year.

The single-pole wishbone idea has been used successfully by utilities for lines up through 138 kv. Spacing arrangements and the moderate, low-humidity climate of southern Arizona permits extension of the design to 161 kv. Minimum phase spacing is 12 ft in the unsymmetrical configuration.

Cost per mile of this construction will run somewhat higher than conventional H-frame lines. But with R/W costs assuming an ever proportion of overall line expenditures, the single-pole wishbone line is expected to be economically justifiable in many locations. Moreover, R/W restrictions in semi-urban areas favor single-pole construction.

Flooding Poses Problem

Local conditions have initiated problems peculiar to this type of line. Future 161-kv lines will be routed frequently along primary roadways and through semi-urban areas with paved roads, curbs, and sidewalks. County roadway regulations may force pole locations adjacent to open irrigation ditches and cultivated fields subjected to irrigation flooding. Predominant Class 7

Barnhart-Plattsburg Transmission Line Statistics

General	
Name	Barnhart-Plattsburg
Voltage, nominal	230 kv
Frequency	60 cps
Length of Line	71 miles
Origin	Barnhart Island, N. Y.
Termination	Plattsburg, N. Y.
Year of Construction	1957-1958
Load, normal	150 kw
Load, maximum	200 kva
Grade of Construction	NESC, Class B
Conductors	
Type	ACSR-Drake
Size, CM	795,000
Stranding	26/7
Lb. per ft.	1.09
Configuration	Horizontal
Span average	625 ft.
Span ruling	900 ft.
Span maximum	1,450 ft
Phase separation	19 ft.-9 in.
Final sag for ruling span	25 ft. (60F)
Tension corresponding	4,220 lb.
Maximum design tension	10,000 lb.
Minimum clearance to ground, general	32 ft.
Minimum clearance to ground, pedestrian area	27 ft.
Minimum clearance to structure (30 deg. Swing)	5.8 ft.
Armor rods	Yes
Vibration Dampers, type	Stockbridge
Altitude range	175-1,380
Structure	
Material	Class 2 wood poles — treated
Type	Braced H-Frame
Average per mile	8.45
Circuits	1
Crossarms	Treated spar
Bracing	Treated spar
Insulation	
Tangent-15,000 lb. M & E	13-5 ¾ x 10 in.
Strain 25,000 lbs. M & E	15-5 ¾ x 10 in.
Basic Impulse Strength-Insulators	1,185 kv
Basic Impulse Strength-Including Wood	1,685 kv wet
Basic Impulse Strength-Including Wood	2,185 kv dry
Surge Protection	
Ground wires	Two ½ in. EHS Steel
Shielding angle, outside wire	30 deg.
Mid span separation, 60 F, average span	19 ft.
Mid span separation, 60 F, ruling span	23 ft.
Arrester BIL	825 kv
Arrester rating	195 kv
Relaying type	Carrier
Breaker interrupting cycles	3
Breaker reclosing cycles	20
Voltage Regulation	
% at 100 PF	2 ½
% at 95 PF	7 ½
Communication	
Type	Carrier

Obtain 161-Kv Single-Pole Line Data

soil will provide much of the foundation of the lines. Poles at the edge of flooded ditches or fields in such soil may tend to heel under abnormal loading.

Pole heights and span lengths in semi-urban areas are governed by crossing clearances over distribution lines with telephone joint attachments. Occasionally, primary distribution underbuilds will be necessary. Structures with adequate pole heights then might tend to deflect under unbalanced conductor and structure loading.

To establish structural data on the new design under some of these conditions, eight tangent structures with wishbone-type crossarms and one single-pole, vertical, 90-deg angle structure were built into a new 69-kv line. One tangent pole was placed to the west and seven to the north of the angle structure so that data relative to prevailing west-southwest winds could be obtained. The angle and three tangent structures are exposed to water ponding by heavy rains and irrigation flooding. The remaining poles are adjacent to a cultivated field liable to irrigation flooding but having good drainage.

Tangent structures are 80-ft, Class 2 Douglas fir poles, pressure creosote treated for the full length. Span length is 320 ft. Present conductors are 477-MCM ACSR, suspended from four 10-in. standard insulators. To simulate future 161-kv line conditions requiring 795-MCM conductors and ten 10-in. insulators, a 200-lb concrete weight, 12 in. in dia and 23 in. long, is interposed between insulators and clamp hardware (EW, Feb 4, 1957, pg 68). A $\frac{5}{16}$-in. SM static wire is strung from the ridge iron, and a 12.5/7.2-kv distribution circuit of three No. 1 and one No. 4 stranded copper conductors is underbuilt to provide maximum anticipated loading conditions.

Heeling Is Checked

The experimental section is inspected periodically during normal weather, after heavy wind storms or rains, and after irrigation floodings. Pole deflections are checked carefully. Comparisons are made on heeling with normal and abnormal wind loading in both dry and wet soil. Additional experiments are in progress with heavily loaded poles adjacent to irrigation ditches.

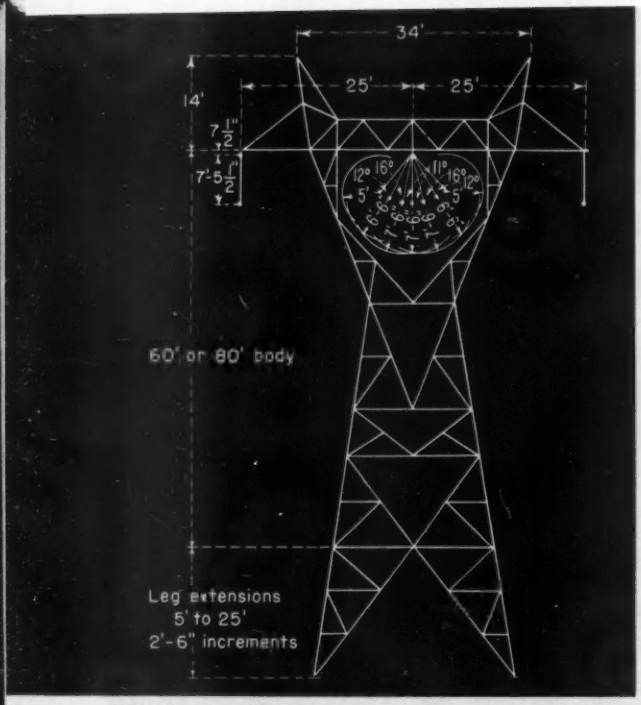
230-Kv Tower

USBR structures have reduced insulation level and accept higher flashover rate

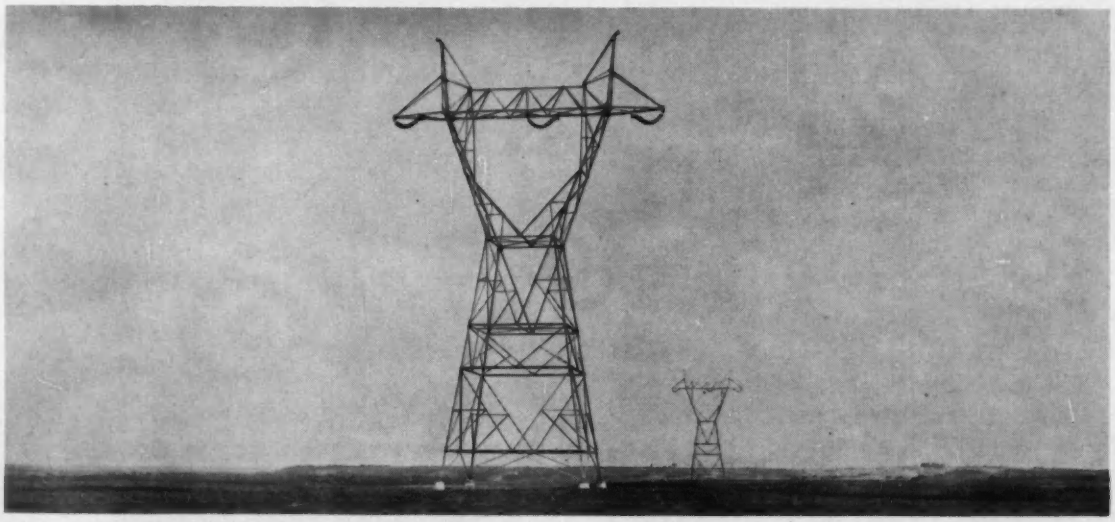
THOMAS M. AUSTIN, Electrical Engineer, U. S. Bureau of Reclamation, Denver, Colo.

Reduction of insulation level and acceptance of a higher estimated flashover rate has meant savings in steel up to 23.6% through the use of smaller and lighter towers on the Bureau of Reclamation's 230-kv Jamestown-Fargo line in North Dakota. The 83-mile line, placed in service last November, as yet has had no lightning outages. An increase from 0.5 to 1.2 flashovers per 100 miles per yr was estimated for an isokeraunic level of 30 when the line was designed. With fast-reclosing circuit breakers on the line, this flashover rate is not expected to impair service.

The single-circuit line is an extension of the Bismarck-Jamestown line completed in 1953. It is a

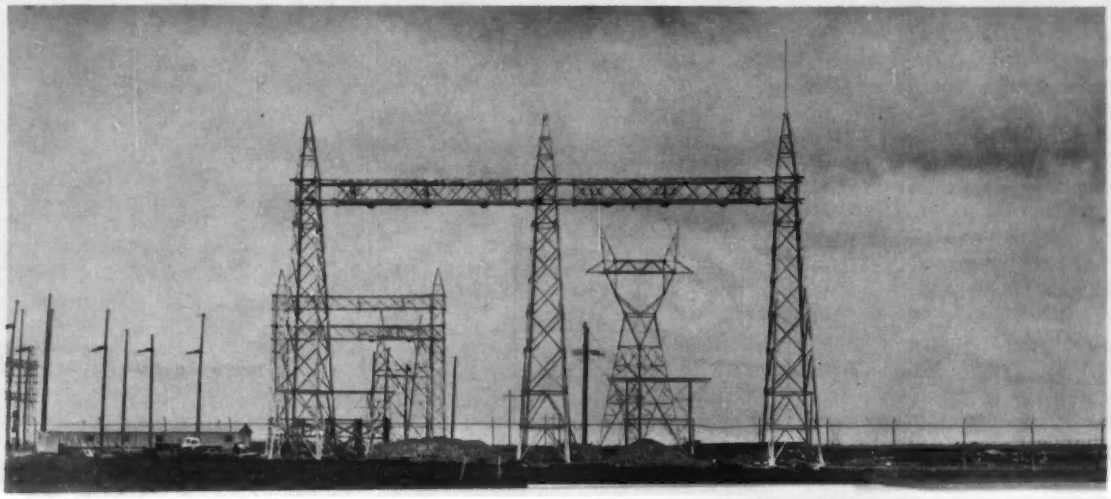


LIGHTER AND SHORTER TOWER for Jamestown-Fargo line uses less steel in suspension structure than previous designs



SMALLER FOOTINGS under towers are possible though reduced overturning moments for the lighter design tower

WESTERN TERMINUS (below) of the 83-mile 230-kv line is Jamestown substation in southcentral part of North Dakota



Design Requires 25% Less Steel

major segment of the Bureau's network of 230 and 115-kv lines transmitting power to wholesale consumers in the Missouri River Basin.

Network analyzer studies of this grid by the Bureau indicate that the average peak on the Jamestown-Fargo line would be 155 Mw under normal conditions with a 50% average annual load factor. To meet these conditions, 954-MCM ACSR was chosen as the most economical conductor.

Size, Weight and Strength Reduced

With reduced insulation level as the premise, critical review was made of previous designs of comparable transmission lines. The new tower design offers reductions in size, weight, and strength. Weight of the standard suspension tower was lowered from 15,700 to 12,000 lb. Electrical and general design data are summarized in Table I, and tower structural design requirements are given in Table II. Tower size was reduced by:

1. Cutting the number of insulators from 16 to 14 in suspension strings, a reduction in the critical positive impulse flashover voltage from 1,425 to 1,265 kv. Number of insulators was reduced from 17 to 15 in deadend strings. This made strings about 1 ft shorter and coordinating clearance from conductor to tower 1 ft less. These factors permitted a reduction in phase spacing from 28.25 to 25 ft.

2. Shortening overhead ground-wire supports about 2 ft. With 1-ft shorter insulator string, midspan clearance from conductor to ground wire is 3 ft less than on previous lines.

Deadend and large-angle towers were designed for full load conditions, all wires broken on one tower face, and a safety factor of 1.5. Standard suspension towers were designed for safety factor of 1.25, except where NESC prescribed a larger one. Safety factors were based on minimum yield point of 36,000 psi for carbon steel and 45,000 psi for high-strength steel.

Basic tower design was premised on NESC heavy-loading conditions. The design was heavied to allow support of conductors and overhead ground wires having 1-in. radial ice and 4-psf wind pressure at zero F with all wires intact. Maximum tensions are 12,000 lb per conductor and 7,000 lb per overhead ground wire for NESC loading conditions. High-strength steel was used wherever appreciable weight reduction could be realized to reduce freight and field erection costs.

Tower Members Built Lighter

Suspension tower member sizes were increased where necessary to meet NESC safety factor of 2.54 for transverse loading on structure and wires due to 4-psf wind pressure. But lighter members were permitted by acceptance of these considerations:

1. For standard suspension towers at tangent points and for line deflections up to 3 deg, the possibility of sustained load on the entire tower, because of a wire broken under ice, is considered remote enough to be an acceptable risk. But peaks and crossarms are capable of resisting initial strain, on the principle that

Table I — Vital Statistics of Jamestown-Fargo Line

Voltage	230 kv
Length	83.04 miles
Structures	Single-circuit steel tower
Design loading	NESC heavy loading (fifth edition) or 1-in. radial ice thickness and 4-psf wind pressure on all conductors with all conductors intact.
Ruling span	1,150 ft
Insulators	Standard 10 x 5¾-in. 15,000 lb
Suspension	Single string, 14 units
Dead end	Double string, 15 units per string
Line conductors	954 MCM ACSR (26 Al/7St), 34,200-lb ultimate strength
Overhead ground wires	Two ½-in. 7-wire, high-strength Class A, galvanized steel, 18,800-lb ultimate strength
Maximum tension at full load conditions, NESC heavy loading	
Line conductors	12,000 lb
Overhead ground wires	7,000 lb
Reduced static design tension for suspension towers	
Conductors	4,500 lb*
Overhead ground wires	3,200 lb (unloaded tension at —40F)
Final tension, 60F, no wind	
Line conductors	5,600 lb
Overhead ground wires	2,750 lb
Final wire sag, no wind, at ruling span	60F / 120F
Line conductors	36.6 ft / 40.4 ft
Overhead ground wires	31.3 ft / 33.9 ft
Midspan separation, conductor to overhead ground wire at 60F at ruling span	27.3 ft
Assumed tower footing resistance	15 ohms
Isokeraunic level	30
Probable outages per year due to lightning	1.0
Corona loss	0.6-kw per 3-phase mile
Conductor clearance, above ground	60F
Uncultivated land	31 ft.
Cultivated land	33 ft
Railroads	41 ft
Transpositions	None

*Unloaded static tension at —40F after suspension insulator swings into ruling span with broken conductor in an adjacent span.

energy released by the initial break is absorbed by those portions of the bolted structure closest to points of load application.

2. Standard suspenison towers were designed for dead load of tower, wind load on tower, transverse and vertical wire loads at NESC heavy loading, plus an unbalanced longitudinal load of 4,500 lb at one conductor position or 3,200 lb at one ground wire position. These loads are equivalent to static reduced wire tension at —40F, no ice, no wind. The cage only is designed to meet an unbalanced impact load of 7,000 lb from one ground wire or 8,500 lb from one conductor with a 1.25 safety factor. Previous towers were designed for these loads except that the entire tower was designed for longitudinal unbalanced loads of 8,500 lb at one conductor position or 7,000 lb at one ground wire position, equivalent to static reduced wire tension at full heavy loading conditions.

Static Wires Run Full Length

Two ½-in., 7-wire, high-strength, weldless, Class A, galvanized-steel overhead ground wires were used from terminal to terminal. Each tower leg was grounded by a Copperweld ground rod driven under the footing. Corona loss per 3-phase mile was calculated to be 0.6 kw. With average elevation of 1,300 ft and conductor diameter of 1.196 in., no objectionable RI has been noticed. Conductors are transposed in substations between line sections rather than in the line.

On suspension towers, single insulator strings of 14 standard 15,000-lb, 10 x 5¾-in. units are used. On deadends, double strings of 15 standard units each are used. Structures are located to maintain conductor side swing such that minimum clearance from conductor to steel is 5 ft with 7.6-psf wind pressure on bare conductor.

Vibration fatigue protection at all suspension points consists of pre-formed, galvanized-steel armor rods on overhead ground wires and tapered aluminum armor rods on conductors. Stockbridge dampers are installed on conductors and ground wires at both ends of each span. Aluminum suspension clamps are used on phase wires.

Four Footing Types Adopted

Reduced tower weights and unbalanced longitudinal load assumptions lowered tower overturning moments and permitted the use of smaller footings. A study of foundation conditions and soils along the line route led to the adoption of four footing types, all using stub angles embedded in reinforced concrete. Each type will resist the most critical combination of thrust or uplift accompanied by shears imposed by the supported tower under design loading, with a safety factor at least equivalent to that of the tower.

Basic footings are:

1. Auger type, undercut or belled at the bottom, with concrete placed directly in the excavation and a cap formed above grade.

2. Pad type, undercut, hand excavated, with concrete placed directly in the excavation and a formed stem poured above the pad.

3. Pad type, not undercut, machine excavated, with formed pad and stem.

4. Pile type, with formed cap and stem over driven timber piles.

Table II—Steel Tower Design Requirements

Safety factors*

Suspension towers, Type SH	1.25
All other types	1.5

Unbalanced loading assumptions:

STRUCTURE TYPE	ASSUMPTIONS
SH, for line angles 0 to 3 deg	One conductor, 4,500 lb, or one overhead ground wire, 3,200 lb
SAH-1 for line angles 0 to 3 deg adjacent to railroad and important highway crossings	Two conductors, 13,100 lb each, or two overhead ground wires, 7,650 lb each, or one conductor and one overhead ground wire, on same face of tower.
TH, for all dead ends and line angles over 15 to 30 deg inclusive	Three conductors, 13,200 lb each and two overhead ground wires, 7,700 lb each, on same face of tower.

Tower Type	Line angle range, deg	Max single span length	Max sum adjacent spans at 0 deg line angle	Max sum of adjacent spans at maximum line angle	Max distance between conductor low points	Max distance between overhead ground wire low points	Max uplift at each conductor or overhead ground wire
SH	0—3	1,575 ft	3,150 ft	2,300 ft	1,575	2,000 ft	
SAH-1	0—3	1,700 ft	3,400 ft	2,300 ft	1,800 ft	2,500 ft	1,500 lb
TH	0—30	2,000 ft	4,000 ft	2,300 ft	2,500 ft	3,000 ft	1,500 lb

Weight of SH type tower, 60-ft body with 20-ft legs and stubs, 12,055 lb

*Based on the yield point of the steel used — 36,000 psi for carbon steel, 45,000 psi for high-strength steel.

The nut that's built to strip

A capacitor with a stripped terminal stud or a broken bushing is useless for service and a tough job to repair. That's why we protect General Electric capacitors against the major cause of such damage.

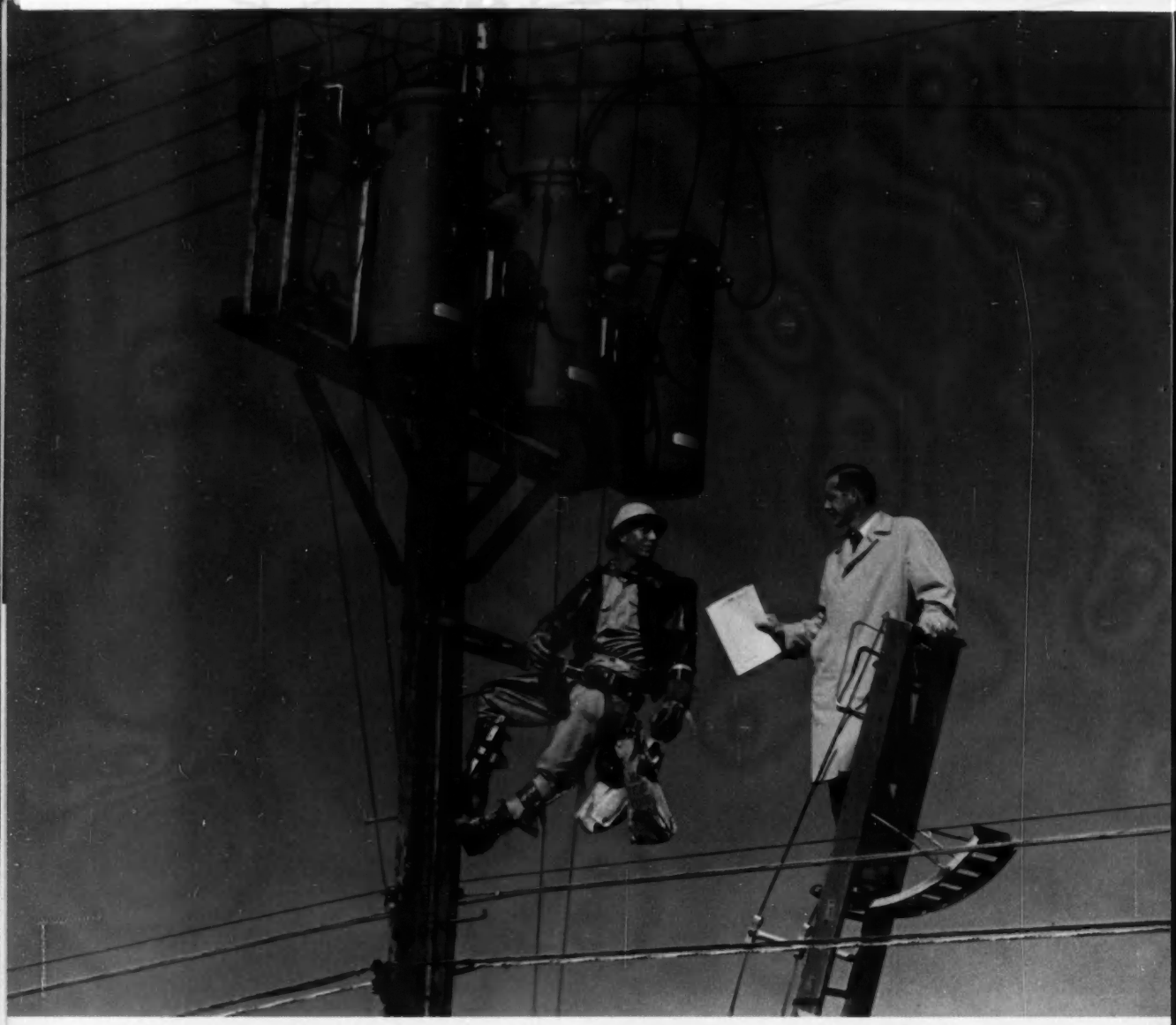
The lineman who forgets his own strength or uses too big a wrench isn't likely to strip a stud or break a bushing on a General Electric capacitor. If excess torque is applied, the softer brass terminal nut is designed to strip first, before real damage is done. All our heavy-handed friend has to do is replace the nut.

Making a strong point out of weakness is another way in which General Electric designers have added to the Engineered Extras that distinguish G-E capacitors.

Want more facts? Your G-E Apparatus Sales Engineer has most of them at his fingertips. Or write to General Electric, Section 445-2, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



NEWEST REASON WHY ALL TRANSFORMERS ARE NOT ALIKE

Aluminum windings can take it!

Three-year field tests of experimental General Electric distribution transformers prove that aluminum windings have what it takes in case future emergencies tie up copper supplies.

Today 134 unique General Electric distribution transformers, like those shown above, are up on poles across the nation. What's unique? Their windings are *aluminum.*

Field tests prove success

The experimental, aluminum-wound units are the result of 18 months of General Electric research, development and manufacture. Now they have passed their three-year field tests. Utility comments such as "no operating difficulties," "performing satisfactorily," and "no troubles whatsoever" underline the aluminum winding's success.

Exceeds NEMA standards

Experimenting with one of the field-tested units back at the plant, General Electric engineers found that the aluminum winding meet all the standards set for conventional transformers, and greatly exceed NEMA requirements for a new unit. G-E engineering research had met the challenge: the aluminum-wound transformer is a success.

G.E. solved complicated problem

When the problem was first tackled, G.E. decided that the aluminum-coil transformer must meet present electrical and mechanical requirements in spite of the widely different characteristics of copper and aluminum. The problem of thus balancing a lighter-weight conductor with lower conductivity had to be solved; new methods of wire drawing and rolling and coil winding had to be developed; and new brazing and welding techniques adopted. Yet in spite of these difficulties, G-E engineers developed an aluminum-wound transformer. In most ratings, it is virtually an exact size-for-size, weight-for-weight replica of its copper-wound prototype with essentially the same losses and regulation.

AL/CU terminals: early development

When utilities began to consider seriously the use of aluminum line conductors, G.E. recognized that new methods would be needed to tie transformers into the lines. For the "cold-flow" of aluminum causes conventional terminals to loosen. The AL/CU terminal clamp developed by G.E. solves the problem by exerting a constant pressure on the conductor.

All Transformers Are Not Alike

Continued research is only one advantage of General Electric Distribution Transformers. Others include *Formex* wire* for reduction in tank size, *new and improved circuit breakers* for self-protected transformers, *complete warehouse stocks* to save utility inventories, and many others—evidence that all transformers are not alike.

LIVE BETTER ELECTRICALLY

For complete information contact your nearest G-E Apparatus Sales Office or write to Section 431-52 General Electric Company, Schenectady 5, New York. 431-52

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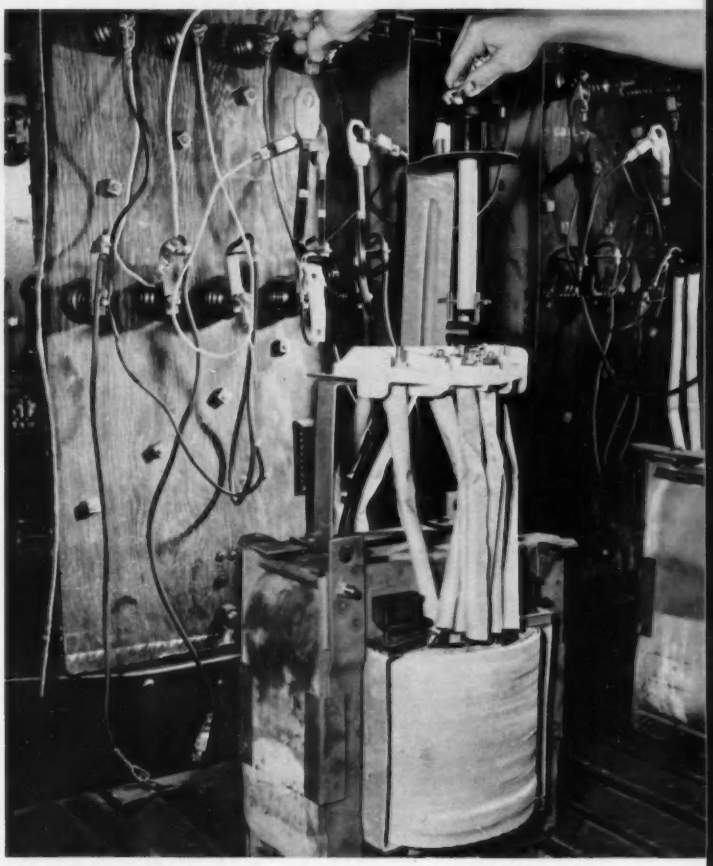
AL/CU TERMINALS on G-E high-voltage bushings save costly service trips by keeping a tight grip on conductors in spite of "cold-flow".



ALUMINUM COIL has passed severe field and factory tests, proving aluminum has what it takes in case copper becomes unavailable.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ROUTINE MAINTENANCE on pole type regulators require about 12 manhours. Safety preparations are elaborate

RELOCATION OF control cabinet to more accessible position reduced maintenance costs and improved safety conditions

DISTRIBUTION—Maintenance

Remounting Cabinet Improves Safety, Efficiency

A. C. SEALE JR., Substation Maintenance Supervisor, Long Island Lighting Co, Hicksville, N. Y.

Moving control cabinets for pole-top regulators to about 10 ft above ground level has resulted in safer working conditions and reduced costs in maintaining this equipment.

Although the primary purpose in the modification was improved safety conditions, an 18-month test scheduled for routine maintenance or adjustment of the regulator indicated a 50% reduction in total manhours.

This reduction in labor costs was obtained by the elimination of elaborate preparation for the job and the task of cleaning up the job site afterwards.

The safer working conditions are obvious when the photos are inspected. When the control cabinet was at the pole top with the regulator, linemen inevitably had to work between primary and secondary distribution lines. Moreover it was sometimes necessary to position the 40-ft extension ladders in busy traffic lanes. Both conditions reduced the degree of safety.

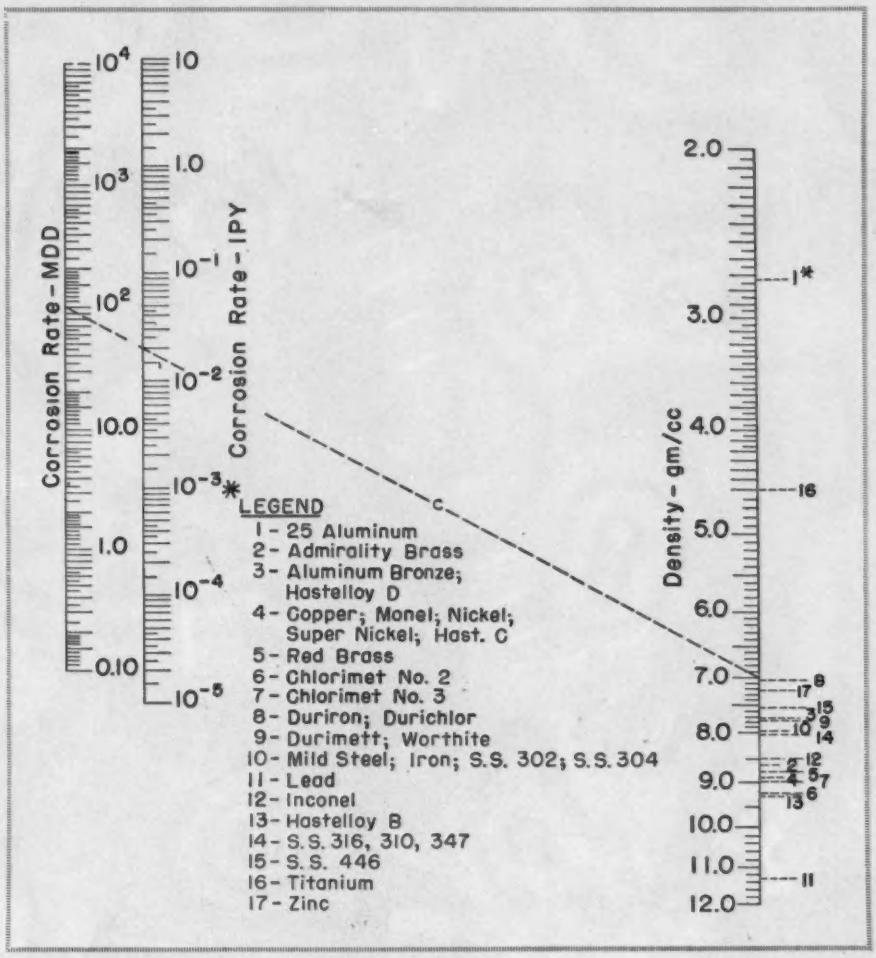
The actual cost of relocating 84 control cabinets was $6,200. It is estimated that the savings in maintenance labor costs per year now obtained would in about 8 years justify this relocation expenditure. In 1955 a total expenditure of $1,514 was made to perform the necessary maintenance on pole-type regulators.

With the relocation of the control cabinet similar expenditures in the future are estimated at $750 per year, resulting in a saving per year of $760.

The control cabinet was lowered to approximately 10 ft above the ground on the same side as the regulator. Flexible seal-tight conduit was used from the top of the regulator to a galvanized conduit secured to the pole, and also from the lower end of the rigid conduit to the control cabinet. Water-tight fittings were used for all conduit connections.

Flame resistant No. 12 stranded single-conductor control wiring make electrical connections.

Corrosion in Inches Penetration per Year


Corrosion Rate - MDD
Corrosion Rate - IPY
Density - gm/cc
LEGEND
1 - 25 Aluminum
2 - Admiralty Brass
3 - Aluminum Bronze; Hastelloy D
4 - Copper; Monel; Nickel; Super Nickel; Hast. C
5 - Red Brass
6 - Chlorimet No. 2
7 - Chlorimet No. 3
8 - Duriron; Durichlor
9 - Durimett; Worthite
10 - Mild Steel; Iron; S.S. 302; S.S. 304
11 - Lead
12 - Inconel
13 - Hastelloy B
14 - S.S. 316, 310, 347
15 - S.S. 446
16 - Titanium
17 - Zinc
C

Nomograph solves graphically the rate of corrosion of various metals and alloys as expressed by equation:

$$IPY = 0.00144MDD/d$$

where IPY = corrosion rate of specimen in inches penetration per year; MDD = corrosion rate in milligrams per square decimeters per day; and, d = density of specimen exposed in grams per cubic centimeter.

Example for Use of Graph

This nomograph can be used to convert corrosion rates expressed as milligrams per square decimeter per day, MDD, to inches penetration per year, IPY.

Problem: If 100 MDD is the corrosion rate of an alloy or metal and its density is 7.0 grams per cubic centimeter, what is the corrosion rate expressed as IPY?

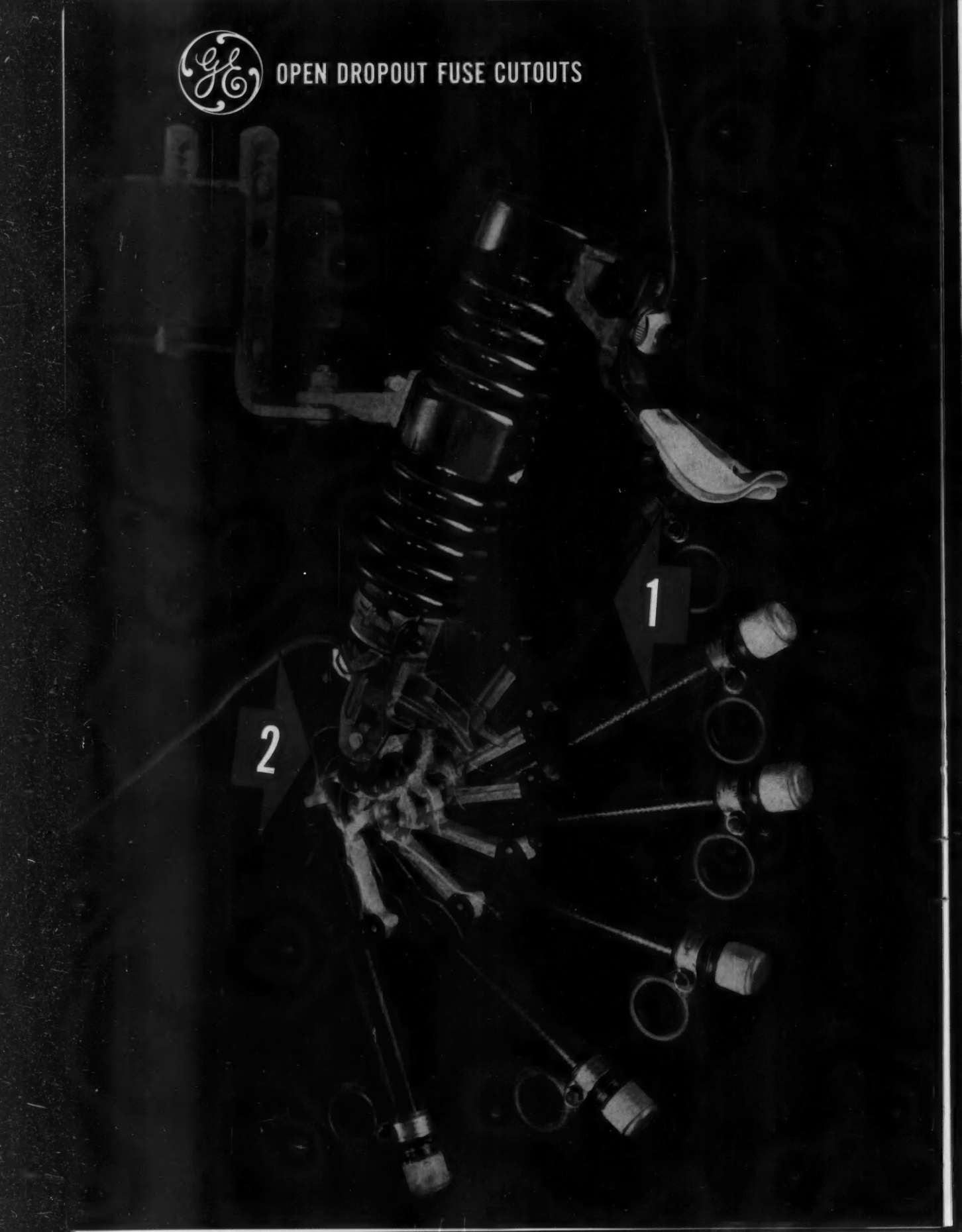
Solution: Connect the MDD value, 100, and the density, 7.0, with a straight edge (dash line C). Where line C crosses the IPY scale, read the corrosion rate as 0.0200 in. penetration per year.

For convenience, the right side of the density scale is plotted with some of the more common metals and alloys corresponding to their approximate densities. Thus, in the example above, the density 7.0 grams/cc might represent approximately the alloys Duriron or Durichlor.

1. Adapted from "Nomographs for Making Corrosion Rate Calculations" by W. A. Szymanski; CORROSION, Vol. 10, No. 12, p. 423.

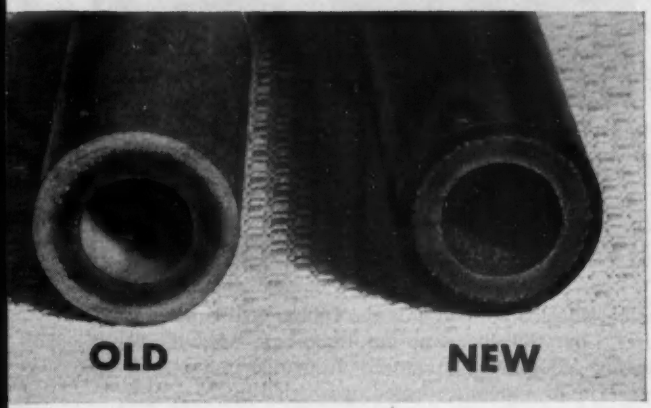
2. Another nomograph, entitled "Corrosion Rate in Milligrams per Day", appeared in ELECTRICAL WORLD, Vol. 147, No. 8; Feb. 25, 1957, p. 74.

OPEN DROPOUT FUSE CUTOUTS

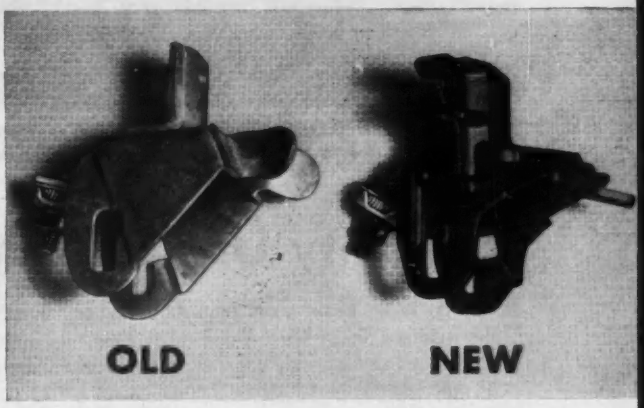


Now—even longer service life from General Electric Open Dropout Fuse Cutouts with

New Polyester Fuse Tube... New Bronze Fittings...



1 **COMPARISON OF OLD AND NEW FUSE TUBES** shows increased thickness of fiber is made possible by a new, thinner but tougher sheath of fiberglass reinforced plastics. More fiber lengthens tube life by allowing greater number of cutout operations with increased reliability.



2 **NEW CORROSION-RESISTANT BRONZE HINGE** (right) has dependable characteristics of old-type galvanized hinge, plus positive operation after years of service in corrosive atmospheres. Fuse-holder drops immediately when fuse blows, slams back easily after re-fusing.

General Electric's new Open Fuse Cutout gives you these important changes that assure even better performance, longer service life and mean fewer problems for linemen.

New fuse tube now features a tough outer protective sheath of reinforced polyester resin. It is practically immune from the effects of weather and age. Improved characteristics and greater strength of this new material permit a thinner sheath, allowing greater thickness of fiber to be used in the fuse tube. As a result, ***these new tubes stand up longer under repeated operations.***

New lower hinge of improved design, together with all component parts, is now made entirely of bronze, virtually ending corrosion problems encountered with galvanized fittings. Hinge won't stick—operates freely after years of exposure even in salt air and other corrosive atmospheres.

Other features include new hanger support construction, compression-clamped fittings, permanent high-pressure contact and latch, long lasting silver-plated contacts, complete bird-proof construction, optional load-break device and disconnect blade.

Heavy-duty ratings include a 15-kv, 100-ampere cutout with an interrupting rating of 4000 amperes and a 7.8-kv, 100-ampere unit with a 5000-ampere interrupting rating.

For complete information, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-20, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

SIXTY MOLDS, FIFTEEN tread designs handle everything from wheelbarrow to bomber tires, use 3 to 20 kw each

ADJUSTABLE INFRARED HEAT, from two dozen 250-w bulbs, dries finished recaps. Process takes eight to thirty minutes

Electricity Ups Quality in Big Recap Shop

Hiram O. West, Power Sales Engineer, Public Service Co. of Oklahoma, Tulsa, Okla.

Buffers, recappers, dryer, conveyor and air conditioning are all electric at the Tom P. McDermott tire recapping plant in Tulsa, Oklahoma. The results: a higher quality product, better control of the recapping process, and cooler working conditions for the employees. Capacity of the up-to-date plant has climbed to 300 tires per day and has prospects of going even higher.

One of the largest electric recapping firms in the West, McDermott has 60 electric recapping molds, can handle wheelbarrow tires, bomber tires, or 900-lb, $2,000 earth moving equipment tires with equal ease. The recappers include 15 different tread designs and use from three to twenty kw apiece. Power consumption runs about 25,000 kwhr per month.

Electric equipment is used in every phase of the recapping process. As the first step in preparing the old casing, electric buffers strip off the old rubber with precision. After a strip of new rubber has been cemented on, the tire goes to the electric molds where thermostatically controlled heat automatically welds the rubber to the casing and imprints the tread. After the tire is removed from the mold and inspected, it is dried by 24 250-w infrared bulbs. The heat is adjustable, drying time varies from 8 to 30 minutes. The tire is then transported by a conveyor belt to the storage room.

McDermott has been in the recapping business 20 years, switched to electric equipment a couple of years ago. Today his half million dollar plant has a staff on one hundred, does a business in tires and recaps that exceeds three million dollars annually.

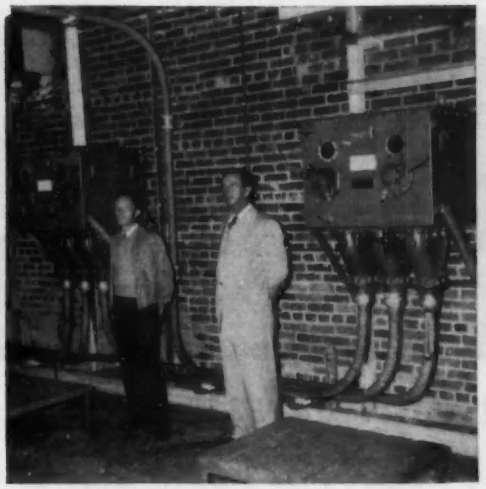
Electric Cable Makes Clean Sweep on Snowy Walk

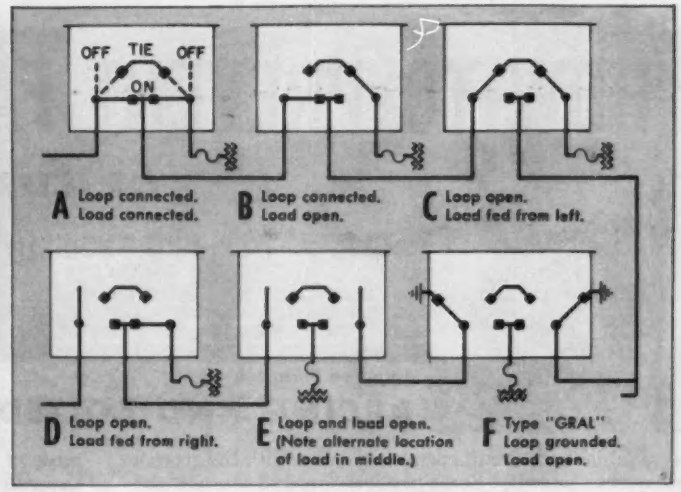
G. W. Cannon, Indust Eng'r, Pennsylvania Electric Co, Erie, Pa.

Electric heating cable, laid under this new factory sidewalk, has eliminated snow cleaning problems at the Lord Manufacturing Co, Erie, Pa. Now a flip of the switch assures a safe dry walk 24 hours a day.

The sidewalk, from gatehouse to employees' entrance, uses 57 sets of electric heating cable. Operated from 208-v line, cables are rated 41.4 kw total. Overall length is about 8,280 ft. Cable was installed after shovelling, chopping and salting, proved unsatisfactory and expensive.

(More Selling on page 114)

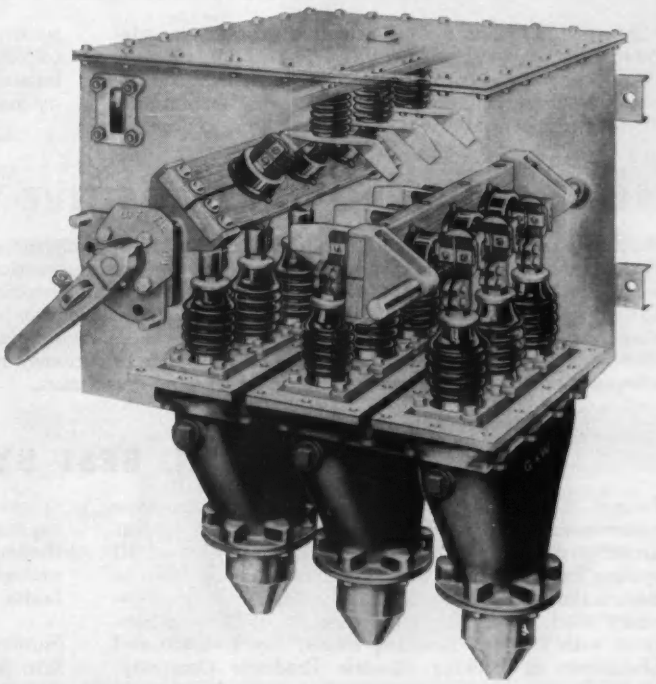



OFF TIE OFF
ON
A Loop connected. Load connected.
B Loop connected. Load open.
C Loop open. Load fed from left.
D Loop open. Load fed from right.
E Loop and load open. (Note alternate location of load in middle.)
F Type "GRAL" Loop grounded. Load open.

Provide distribution system F-L-E-X-I-B-I-L-I-T-Y with G&W Type "RAL" *LOAD BREAK* OIL SWITCHES

Type "RAL" oil switches with three ways (2 feeder and 1 load), two sets of links, and tie buses are designed for use on loop circuits and in other situations where similar flexibility would otherwise require three separate oil switches with correspondingly greater expense for equipment, installation, and space.

The diagrams above show six of the connections possible with the "RAL" switch. The novel link arrangement permits the loop to be connected through the switch with or without the load connected—it permits the load to be connected to either side of the loop with the other side disconnected—and it permits any section of the loop to be isolated (and grounded) without interrupting service to any of the branches. The load cable can be terminated in the middle (either feeder can be grounded) or in either of the outer cableheads (load can be disconnected without interrupting loop).



Standard "RAL" switches are made in 400 ampere (full load break) rated 600, 7,500 & 15,000 (illustrated) volts. Special designs for 23,000 and 34,500 volts and for 1000 amperes.

Send for series "D" bulletins.

Type "RAL" switches are combined into special units with "FC" OIL FUSE CUTOUTS or with POWER FUSES to save equipment cost, installation labor, and space.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS

Representatives in many cities of U.S.A., N. & S. America — Canadian Mfr. – Powerlite Devices, Ltd., Toronto, Montreal & Vancouver — D571

G&W

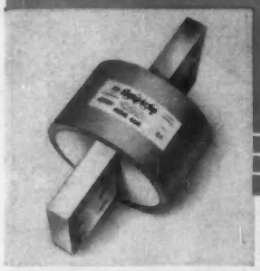
High Voltage Cable Terminating, Sectionalizing, Protecting, and Connecting Devices

POTHEADS • BOXES • OIL FUSE CUTOUTS • LOAD BREAK OIL SWITCHES • SPLICING KITS

HOW TO PREVENT FAULT CURRENT

OR CURRENT LIMITATION Vs.

OR Amp-trap® Vs. Circuit Breakers—



Amp-trap Form 480

ARCING AND BOLTED FAULT DANGER

Available short circuit currents increase with the growth of system capacity. Some network systems can now deliver more than 100,000 Amperes R.M.S. at feeder duct points and over 50,000 Amperes R.M.S. on plug-in duct. This means that maximum protection against fault currents of high or low magnitudes can be obtained only through a protective device that will *instantly* de-energize the circuit. *Amp-trap* is such a device because its patented† construction gives microsecond response to fault currents of any magnitude.

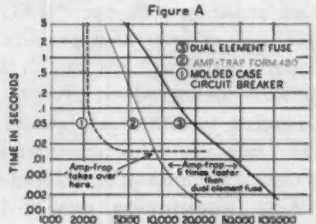
CONVENTIONAL PROTECTION

Circuit breakers* and dual element fuses may be adequate to open at 100,000 Amperes R.M.S. but they are so slow that fault currents build up to their maximum peaks of destruction before they can open. Conventional circuit protective devices just aren't fast enough or sensitive enough to stop the build-up of fault currents to their maximum peaks of destruction. Consequently, busways, panelboards and switch gear are destroyed by magnetic distortion, arcing and burning.

Amp-trap® PROVIDES POSITIVE PROTECTION

Amp-trap, on the other hand, *anticipates* the build-up of enormous available fault currents, and limits them to low values. It prevents destruction by clearing the circuit in a fraction of the time it takes for a circuit breaker's contacts to open, or for a dual element fuse to blow. As shown by the curves in Figure A, dual element fuses are even slower than circuit breakers. Along with standard One-Time and Renewable fuses, they can no longer be seriously regarded as adequate protection against magnetic and thermal demolition.

Figure A



Time-current characteristics at various 600 ampere protective devices.

Amp-trap® BEST BY TEST

Recent tests on bus duct prove *Amp-trap* protects two ways: (1) against heavy fault currents (2) against arcing faults. Sustained arcs, the most elusive of all system hazards, travel fast along bus-bars and burn to destruction as they go. The AIEE paper 56-46, February 1956, "Short-Circuit Protection of Busway Systems with Current Limiting Fuses," by Cataldo and Shackman of Bulldog Electric Products Company, proves *Amp-trap's* protective ability against both arcing faults and bolted faults. At the same time, it proves that neither circuit breakers nor dual element fuses can protect apparatus against either low or high magnitude faults.

Similar bus duct tests by other manufacturers confirm *Amp-trap's* superiority.

NOTHING TAKES THE PLACE OF Amp-trap®

Mere interrupting capacity in a circuit breaker* or fuse does not protect apparatus from fault current destruction. Only current-limiting *Amp-trap* or *Amp-trap* protected circuit breakers can do this. They alone have current limiting ability and almost unlimited interrupting capacity, as well as the sensitivity needed to prevent arcing faults. The following tests prove this.

®*Amp-trap* is a registered trade name of The Chase-Shawmut Co. and refers to a current limiting device and herein is written *Amp-trap*.

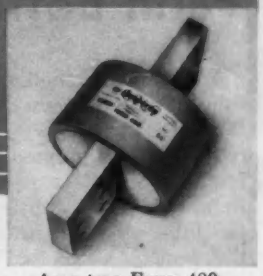
*All circuit breakers except the I-T-E Cordon with integral Amp-traps or others with coordinated Amp-trap protection.

†*Amp-trap* is covered by one or more of the following patents: 2,557,926; 2,592,399; 2,594,315; 2,599,646; 2,647,970; 2,653,203; 2,658,974; 2,662,140; 2,665,348; 2,670,418; 2,681,398; 2,703,352; 2,713,098; 2,734,110; 2,734,111; 2,734,112; 2,740,187; 2,740,735.

DAMAGE TO BUSWAY SYSTEMS

INTERRUPTING CAPACITY

Dual Element & Standard Fuses



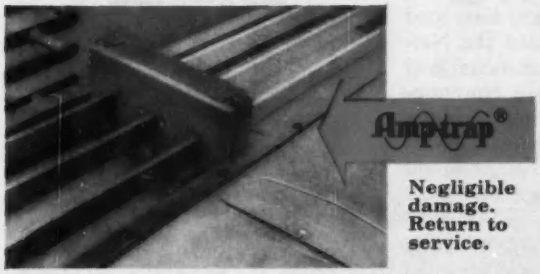
Amp-trap Form 480

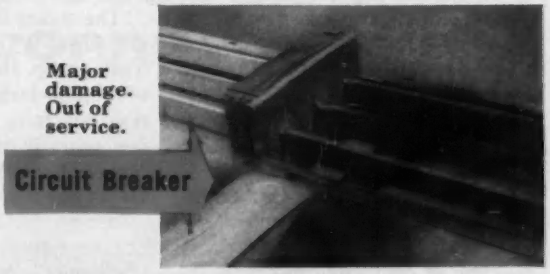
ARCING FAULT TESTS

(Low Current Tests)

Three-phase 480 volt arcing fault tests on 200 Ampere bus duct with ¼″ x 1″ bus-bars. Insulators spaced on 20″. Arc started by bridging bus with fine fuse wire. Circuit Breaker rating: 600 Amp., 600 Volts, 3 Pole, Int. Cap. 50,000 Amps., R.M.S.

Amp-trap Form 480, 800 Amp., 600 Volts — *4 times normal bus-bar current rating, blows only on fault currents.*





Protection	Available Fault Current RMS	Peak	Max. Let-Through Current	Duration of Fault Cycles	Busway Burning Damage	Condition
Circuit Breaker	20,500	31,000	31,000	3.1	Major	Out of service
Amp-trap	20,500	31,000	21,000	.73	Negligible	Return to service

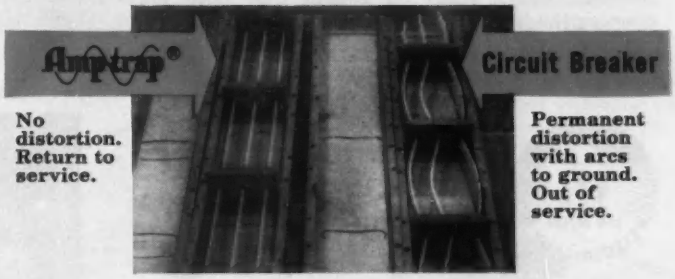
BOLTED FAULT TESTS

(High Current Tests)

Three-phase bolted fault tests on 200 Ampere bus ducts with ¼″ x 1″ bus-bars, insulators spaced on 24″ centers, case energized by connection to center bus.

Circuit Breaker rating: 600 Amp., 600 Volts, 3 Pole, Int. Cap. 50,000 Amps., R.M.S.

Amp-trap Form 480, 800 Amp., 600 Volts — *4 times normal bus-bar current rating, blows only on fault currents.*



Protection	Available Current RMS	Peak	Max. Let-Through Current Peak	Fault Duration Cycles	Avg. Max. Deflection	Distortion (Permanent Set)	Condition
Circuit Breaker	35,000	51,800	51,800	2.00	1.125″ Arced to case	1.125″	Out of service
Amp-trap	35,000	51,800	24,000	.27	.10″	0.″	Return to service

For further information on *Amp-trap*, get in touch with us here at Newburyport.

REGISTERED U.S. PATENT OFFICE
Est. 1893

AMP-TRAPS – *"Awake At The Switch"*

THE CHASE-SHAWMUT CO.

373 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Subsidiary of I-T-E CIRCUIT BREAKER CO., Philadelphia, Pennsylvania

Represented in Canada by Powerlite Devices Ltd.

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2,658,974; 2,662,140; 2,665,348; 2,670,418; 2,681,398; 2,703,352; 2,713,098; 2,734,110; 2,734,111; 2,734,112; 2,740,187; 2,740,735.

SELLING (Continued)

FARM ELECTRIFICATION

'Farm Better Electrically' Plans Unfolded

Plans for a promotional and educational farm program called "Farm Better Electrically" were announced recently. The proposal would do for the man of the soil what Live Better . . . Electrically is doing for the urban family. And, similarly, the project would be backed by cooperative efforts of electrical industry segments selling to the farm market.

"Farm Better Electrically would benefit from the impetus of Live Better Electrically," said Marty Whithead, a spokesman for Edison Electric Institute's Farm Group committees. But FBE would tap the farm production field, a field that's relatively undeveloped so far as unified industry promotions are concerned, he added.

Whithead, Farm Sales Supervisor, Atlantic City Electric Co, officiated at a recent New York meeting of manufacturing representatives, editors of farm publications, rural sales people of electric companies, and members of other interested group spokesmen. The meeting's purpose: To describe the proposal, solicit ideas on gaining cooperative backing, and suggestions for coordinating it with national programs like LBE and Housepower.

An earlier meeting in Washington, D. C., followed this outline with inter-industry people, trade associations, and government officials attending. The reaction there was described as "encouraging." Recently, EEI committee members described the plan to manufacturers of farm power equipment in Chicago.

Farm Stakes Can Be High

The stakes in electrical farm load are high, Whithead told the New York group. He said a national goal of 10,000-kwhr average consumption per farm is feasible within a few years if unified industry backing is obtained. This usage would be more than double last year's average.

Potential for makers of farm equipment is equally good. He cited a recent survey in Kansas that revealed an immediate market for $20 million worth of electrical equipment.

Farm Better Electrically would be both promotional and educational in scope. Here's how Whithead described its benefits:

- FBE would help the farmer cut costs. It would help solve the farm labor shortage problem, boost production, improve quality, and cut the drudgery of materials handling.
- Added revenue for farmers gained from use of electrical equipment would be a shot in the arm for the whole economy.

SYMBOL used in its own Farm Better . . . Electrically program was developed at Georgia Power Co. Designed to tie in with Live Better . . . Electrically, it is helping make farmers aware of the fact that electricity will improve techniques, increase production, and lower costs, according to the company. FBE is not a program; right now it is being used by the company only as another tool for rural promotion.

LBE Caravan Goes on Road in Philly

The Live Better . . . Electrically Caravan, a GE contribution to the nationwide promotion program, went on the road last week in Philadelphia. The caravan, made up of four trailers, each of which opens up into an exhibit stage, was co-sponsored at the Philadelphia home show from Feb. 11-16 by Philadelphia Electric Co. The trailer-exhibits feature such things as a brief story of how electricity is made and sent to the home, light conditioning, the GE Weathertron heat pump, closed circuit TV (Visitors can see themselves on a screen), a walking, talking refrigerator named "Junior", a Housepower demonstration, and others. The show caravan will visit state fairs and trade exhibits in 14 cities in 10 states during the next 9 months, and will be seen by an estimated 10 million people.

CARAVAN KITCHEN is one of four trailer-exhibits at General Electric Co's 'Live Better . . . Electrically' Caravan. Show will tour nation at state fairs and local trade shows

(More Selling on page 116)

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DESIGNED FOR ALUMINUM

HIGHEST QUALITY

FARGO "9000" SERIES

"One-piece" aluminum connectors

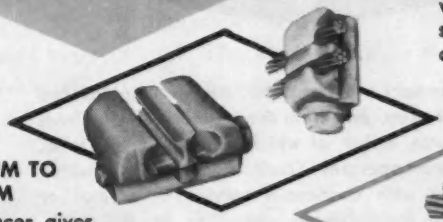
CAREFULLY INSPECTED

UNIFORM DEPENDABILITY

EASY TO USE

FOR ALUMINUM TO COPPER

Bimetal inserts of pressure welded aluminum and copper sheet. Excellent conductor encirclement and separation.



FOR ALUMINUM TO ALUMINUM

Pure aluminum spacer gives high conductivity. Extra wide contact surfaces. Large mass for heat dissipation.

LONG, LONG LIFE

Ask your Line Material Field Engineer for complete details.

Distributed by
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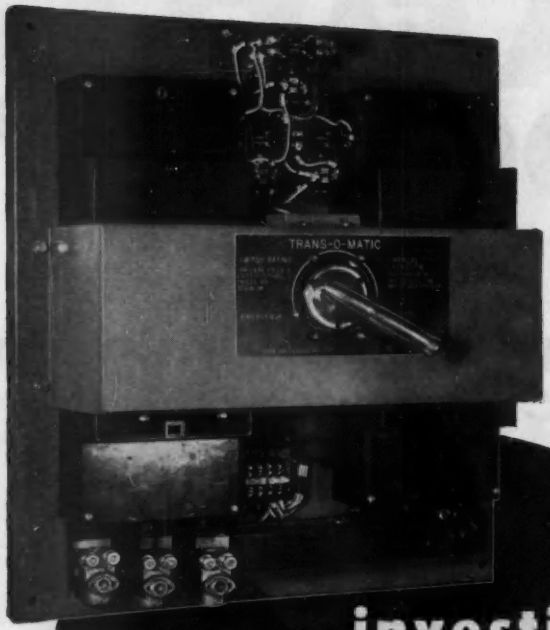
Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

FARGO

seen by an estimated 10 million people.

(More Selling on page 116)

if YOU'RE responsible for POWER CONTINUITY



TOTAL FAILURE PROTECTION

PARTIAL VOLTAGE FAILURE PROTECTION

POSITIVE NORMAL OR EMERGENCY POSITIONS ONLY

investigate TRANS-O-MATIC AUTOMATIC TRANSFER SWITCHES

Trans-O-Matic's compact, failure-proof design employs two standard circuit breakers, one from the normal and one from the emergency source, either of which will supply the load. Relay-actuated motor operates circuit breakers for positive mechanical transfer with continuous service in normal or emergency position. Available in capacities to 600 volts, 800 amps, interrupting capacities to 50,000 amps RMS. Prompt delivery in most sizes.

OPTIONAL FEATURES

Adjustable time delay on restoration to 20 minutes • Engine starting contact • Test pushbutton • Pilot lights for switch position • Special enclosures

LAKE SHORE Electric CORPORATION
BEDFORD, OHIO

SELLING *(Continued)*

USDA Survey Shows Use of Electricity on Farms Is Up

Use of electricity both in farm homes and farming operations is still increasing, according to a report of a 10-year Federal-State survey issued by the U. S. Department of Agriculture. Here are some highlights:

- Although about 95% farms are now electrified, average consumption per farm and total electric power consumption on farms continues to rise.
- More than 400 applications of electricity on farms have been identified.
- Farm households in general require more power than do farming operations. Households, depending on the region surveyed, used 58 to 87% of total power consumed on farms, while farming operations took only 3 to 30%. An additional 5 to 26% of total was required for lighting farm homes and service buildings.

Single copies of Agricultural Information Bulletin No. 161, "Use of Electricity on Farms", giving results of survey, are available at no charge from Office of Information, Department of Agriculture, Washington 25, D. C.

D&B Survey Finds Repairs Can Cost Money, Goodwill

"Products That Come Home to Roost", an article in the February issue of Dun's Review and Modern Industry, is the results of a survey of product repair policies and practices in a wide range of companies.

Servicing and repairing returned products is often a major expense for the maker, but refusing to do so can be even more costly in customer goodwill.

Here are some of the survey's highlights:

- Most companies try to bring repair charges into line with actual costs. Some do it by charging for parts at current market prices. Others use short-term, realistically priced maintenance contracts. Mak-

(Continued on page 118)

CUT-AWAY VIEW OF
VICTOR NO. 9-R (EEI-NEMA 55-5)
LOW VOLTAGE RADIO-FREED PINTYPE INSULATOR

NO INSULATOR IS MADE WITH GREATER CARE THAN A *VICTOR* PINTYPE!

VICTOR Pintypes are designed and manufactured with the same *Purified* Porcelain as high voltage units. VICTOR Pintypes are design-tested with steep front impulse wave in addition to the normal 1.5 x 40 standard impulse wave.

The conductive glaze on VICTOR radio-freed units is readily *distinguishable* and *permanent*. Accurate, die-formed porcelain threads assure ease of installation. Machine glazing guarantees uniform glaze application, giving optimum dielectric and mechanical strength. *Every* VICTOR Pintype receives the same careful routine electrical testing as VICTOR high voltage insulators. That's why—when you buy VICTOR, you just can't buy better pintypes.

New . . .
VICTOR CATALOG

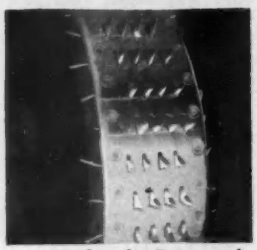
Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for your copy.

Nothing beats Porcelain
FOR ELECTRICAL INSULATORS!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO., Inc.
VICTOR, N.Y.

BELL POLES ARE TREATED RIGHT

. . . through precision incising



Hydraulic Powered Fiber Spreading

No pounding or hammering is applied to Bell poles in processing for penta or creosote treatment. Instead each pole is carefully incised to a specified depth by controlled hydraulically powered fiber spreading machines. Engineers have pronounced Bell machine type pole incising decidedly superior to ordinary pounding and hammering methods; wood fibers are not crushed or broken down and maximum oil is absorbed in treatment. Such poles are stronger—free from sliverings—abrasions—loosened sapwood—last longer. Of course, only the finest poles from Bell's own timber lands are selected for processing and treatment.

We will appreciate an opportunity to bid on your pole requirements. Write, wire or telephone Bell Lumber and Pole Company, Midland Bank Building.

BELL LUMBER AND POLE COMPANY

NEW BRIGHTON, MINN. — LUMBY, CANADA

MIDLAND BANK BUILDING

MINNEAPOLIS, MINNESOTA

SELLING *(Continued)*

ers find charges rarely cover costs.

• Producers of big consumer products usually assume no service responsibility beyond the warranty period. Service is generally done by distributors or dealers.

• A. R. Gardner, DRMI's industrial editor, suggests that the best way to keep service costs down is to keep products from coming back to the factory by encouraging trade-ins, supply changeover kits, training field repair organizations, providing detailed service manuals, and checking on repair work for completeness.

• Where there is a heavy volume returned, most experts say to set up a separate repair department. It may be simpler just to run repairs down the production line, but it is expensive. The separate repair department costs less in the long run.

Expect Utilities—Dealers to Work Closer

Closer utility-dealer cooperation is expected soon as a result of growing teamwork between EEI and NARDA, according to a front-page item in NARDA News.

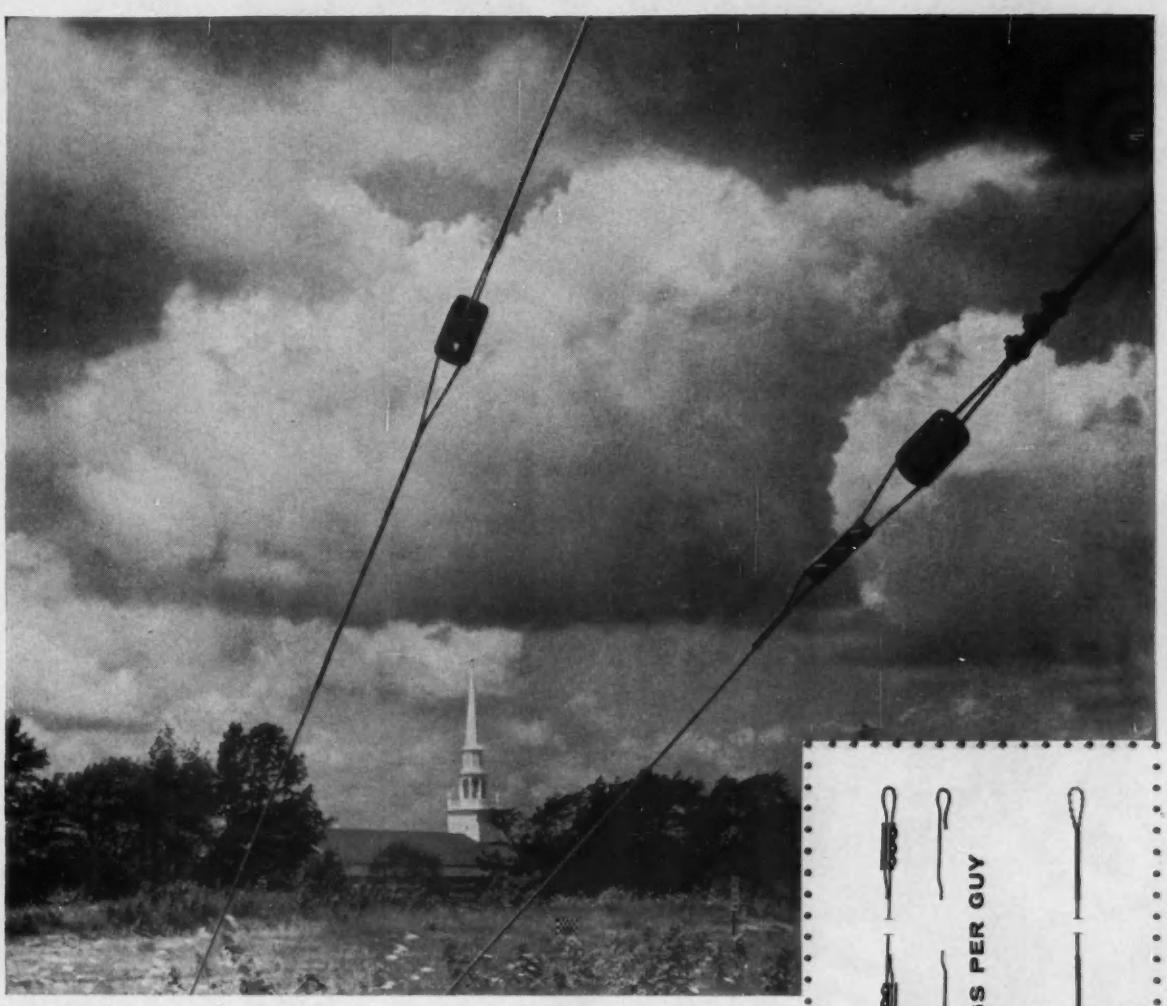
Robert Coe of Union Electric Co, St. Louis, Mo., chairman of EEI's Residential Committee has invited NARDA's Executive Committee to confer with EEI leaders. Purpose of the confab: to work out methods of greater dealer participation on the national promotions of EEI

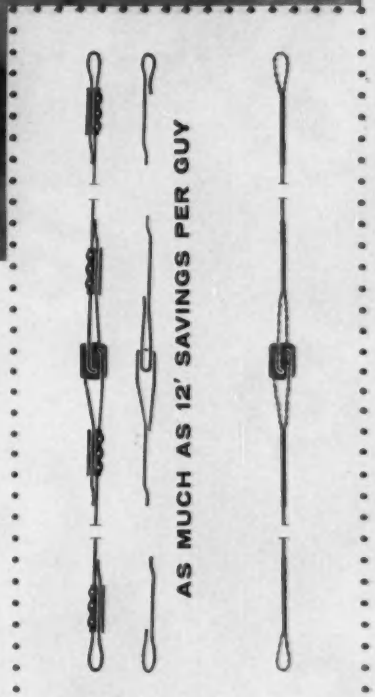
Appliance Sales Off

Factory sales of home laundry appliances in January dropped to 498,865 units, 12% below the same period for 1956, according to American Home Laundry Manufacturers Association. Washers led the decline, slumping to 331,314 units, or for a 16% drop from January, 1956. Dryers and ironers also slipped, losing 13% and 12%, respectively.

Generally, appliance production cutbacks are spreading. Westinghouse is furloughing 665 workers

(Continued on page 121)





Up to 30% savings in strand... with PLP Guy-Grip Dead-Ends

You will find real guying economy with PLP Guy-Grip dead-ends. Because they eliminate strand looping, you can use *shorter, straight* lengths of guy strand. This means as much as 12 feet savings in strand per guy. What's more, the finished installation is neat, streamlined, efficient.

PX-80

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO
DEPT. NO. PR1B
Telephone: Cleveland EXpress 1-3571

MINNEAPOLIS, MINNESOTA

(Continued on page 121)

Imagine the wrath of this boy . . . and thousands of others in his community . . . if power outages cut off the TV at the "crucial moment". That's where C-D's field-proved dependability pays off . . . regardless of changing weather or power load conditions. The thousands of C-D power capacitor installations . . . all with records of better than 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.

CORNELL-DUBILIER CAPACITORS

consistently dependable for power-factor improvement

CORNELL-DUBILIER
power-factor capacitors give you better than 99.6% trouble-free service*

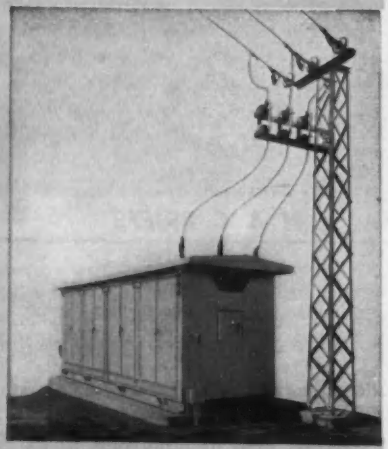
Low dielectric unit stress provides an extra margin of safety that results in the ability to withstand higher transient voltages. When you buy C-D, you buy premium quality at no extra cost.

Extra strength wet process two piece porcelain terminals . . . one of the many important reasons why C-D capacitors can point to year after year of trouble-free service in coastal areas.

Another evidence of C-D's premium quality power capacitor service . . . at no extra cost . . . is the fact that C-D has no "Return Material Department". Most repairs are of such a minor nature that they are handled on an individual basis. This results in a prompt, personalized service impossible where the safety factor has been cut in favor of production, weight and size economies.

C-D's rack capacitors are shipped completely assembled ready for energization. Again C-D's conservative engineering standards provide the structural strength to do this and as a result save the utility time, assembly and installation costs in the field.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.



Part of a 37,000 KVAR C-D installation at substations of a large Western company.

***This is an average based on reports from leading utilities using C-D capacitors.**

SELLING *(Continued)*

from its Mansfield, Ohio plant until June. GM's Frigidaire Division and General Electric are both reducing their work forces by some 1,700 workers.

LIGHTING NOTES

• In an effort to reduce the traffic toll and bring beauty and safety to their streets, three more municipalities in northern California have installed modern street lighting facilities. They are San Leandro, in Alameda County, and Milpitas and Barron Park, both of Santa Clara County.

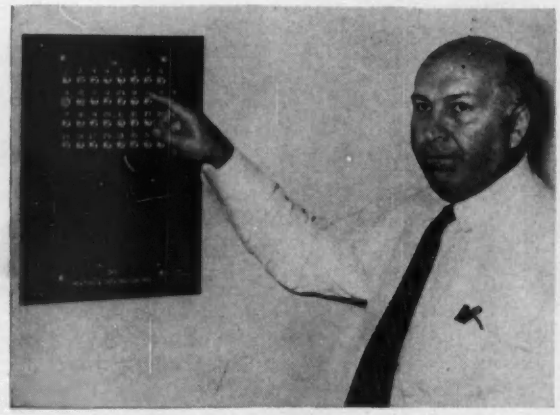
• Twenty four utility lighting engineers recently took part in a two-day advance engineering conference at Holophane Co's Light & Vision Institute in New York. The conference covered current lighting trends, markets, engineering design and application features, and ended with a seminar on entitled "Relations among Electric Utilities," held at EEI's New York headquarters.

• General Electric Co is expanding its marketing service within the residential lighting industry, according to a recent announcement by J. C. Forbes, manager for marketing development for GE's Large Lamp Dept. The expansion is said to be part of the company's participation in the "Living for Light" program.

• Parallel-to-roadway lighting, a new and experimental system of street and highway illumination, was demonstrated recently by General Electric Co at their "Outdoor Lighting Center of the World" in Hendersonville, N. C. Although company spokesmen emphasized that the new system is strictly experimental, and much testing is still ahead, they pointed out that it has some advantages, namely: a virtual elimination on brightness fluctuation, freedom from glare, and a greater attainable quantity of light on the thoroughfare.

(More Selling on page 122)

PLANTS IN SO. PLAINFIELD, N. J., WEST BEDFORD, WORCESTER
AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD
AND FUQUAY SPRINGS, N. C., SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO



A flip of an office switch controls . . .

Continental Radiant Glassheat Corp Photos

radiant heaters in each room of this . . .

Electrically Heated, Centrally Controlled Motel

The registration clerk at Hinton's Motor Lodge in Irving, Texas, doesn't even have to leave his desk to make sure his guests are comfortable. He can set the temperature in any room from a central panel that controls the radiant glass electric heaters and the air conditioners in each room.

Thirty rooms plus an office, lounge, and conference room make for an additional 107 kw of connected heating/cooling load. The motel is on Texas Power & Light Co's lines.

Heat loss for each of 30 rooms varies between 9,940 and 13,068 Btu hr. Total loss for the lounge, office and conference room is 130,209 Btu/hr, almost half of which is in the lounge—which has three solid walls of glass. Twelve radiant units are used to heat it. (Heat losses calculated on basis of 0 F outside, and 70 F inside.)

The motel has not been in operation during one complete heating and cooling season, so costs are not fully known.

Owner was sold on electric heat *after* his specifications had been drawn up. These originally called for vented gas wall heaters plus auxiliary electric heating.

Radiant Glassheat of Texas, Inc, the distributor, sold the owner and architect on changing to electric heat on the following points:

- Rooms can be individually controlled both in the room itself and centrally from the office. This saves on operating expenses when rooms are vacant.
- Maintenance and replacement costs are practically negligent with radiant electric heat.
- Preferential insurance rates for all-electric multiple-dwelling buildings such as motels.
- Reduced cleaning and redecorating costs because electric heat emits no fumes or smoke particles.
- Electric heat gives better "atmosphere conditioning". No oxygen is consumed. Humidity is more easily controlled. Infra-red rays from radiant heat are considered healthful for certain common ailments.

H & C BRIEFS

Electric Heat for Health!

Dr. C. E. Clifton, Stanford University scientist, has discovered that an ordinary electric heater kills about half the germs and most of the viruses in the air of a room during the warming-up process. Dr. Clifton said that although the virus involved is harmless to humans, the high rate of kill was significant. It means, he said, that such heat would wipe out practically all the really harmful viruses in the air of a room.

Monthly Heat Bills Easier to Pay

Seattle, Wash., City Light has agreed to send monthly bills to its electric heating customers rather than bi-monthly ones, at the request of many customers. During winter, bi-monthly bills become too large to pay conveniently.

Biggest 'Indoor Weather' Job

The Seagram building, now under construction on New York's Park Avenue, will be air conditioned by the largest single installation of Carrier Corp's Weathermakers ever put in one structure. The glass and bronze skyscraper will have some 3,600 of the units.

Many of these reports have shown
100% trouble-free
service, and none lower than 98.9%.

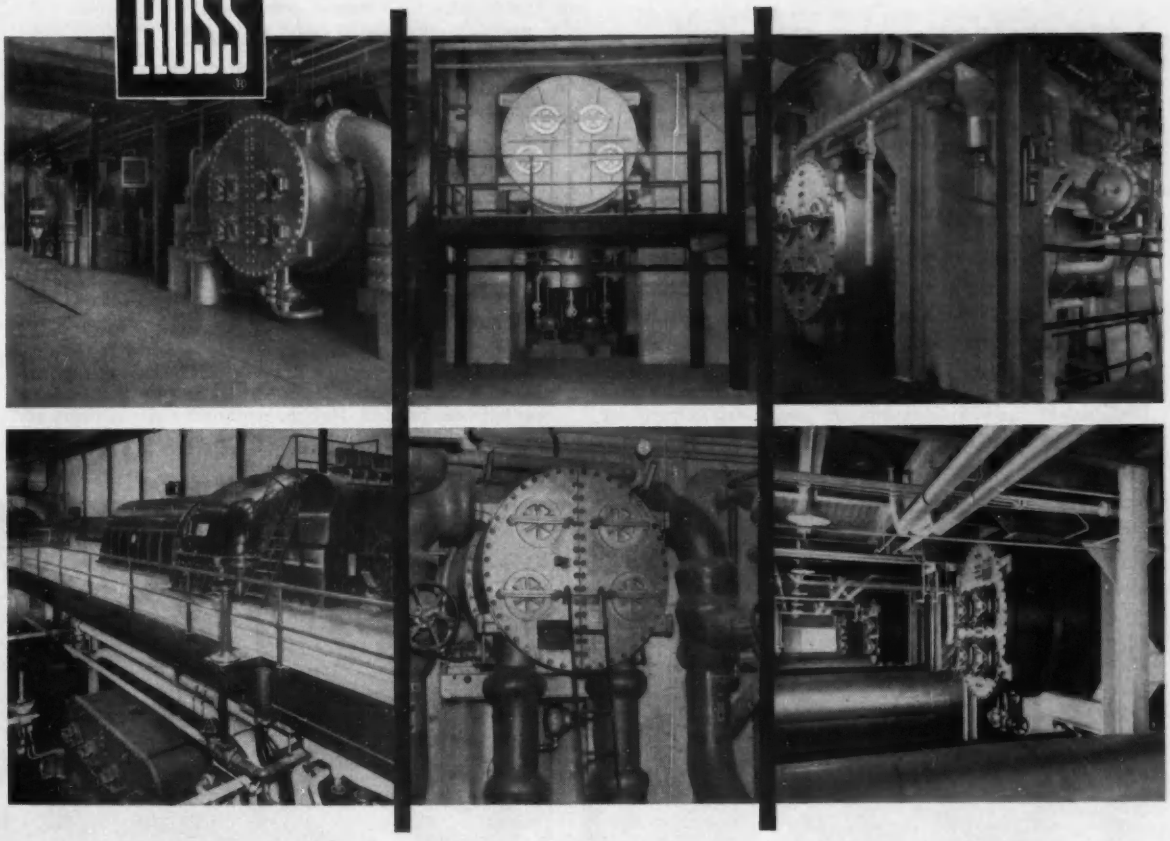
(More Selling on page 122)

the fame of a good product travels far . . .

ROSS SURFACE CONDENSERS

serve power plants everywhere

ROSS



Pre-eminence of Ross engineering and manufacturing has won many customers . . . and kept them . . . here and abroad.

Public utilities, municipalities, industries, institutions, office buildings . . . some equipped with large twin bank designs, others with smaller single bank units . . . number among Ross installations which date back 40 years.

Long a leading, exclusive producer of heat exchange and condensing equipment . . . long a pace-setter with major innovations . . . Ross has a versatile experience to offer in the interpretation *and fulfillment* of your requirements. Consulting engineers, contractors, architects or plant men . . . whoever specifies . . . all like to work with Ross engineers in the solution of condensing and heat exchange problems.

New Bulletin 8.2K1 gives you the reasons why. Write for your copy, please. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS HEAT EXCHANGER

Division of AMERICAN-Standard

Answers to

about Kaiser Aluminum's purchase of

As part of its continuing growth program, Kaiser Aluminum & Chemical Corporation recently purchased the Wire and Cable Division of United States Rubber Co., located at Bristol, Rhode Island. The purchase raises a number of questions that are of direct interest to customers of both Kaiser Aluminum and the former Wire and Cable Division of U. S. Rubber. Here are the answers to those questions.

Q. Will all of the U.S. Rubber products still be available?

A. Yes, ALL of the wire and cable products formerly offered by U.S. Rubber will continue to be produced and sold—without changes of any kind.

Q. Who will back up the U.S. Rubber guarantees now? What about replacement?

A. Kaiser Aluminum will guarantee all U.S. Rubber Wire and Cable Division products now in use on the same terms as originally established, including replacement. Former U.S. Rubber products (which will continue to be offered) will carry the same guarantees as before.

Q. I have always liked the way U.S. Rubber people have served my needs; who will be doing the job now?

A. The same people who served you before will serve you now. The purchase includes acquisition of Wire and Cable Division's nationwide sales organization, as well as the plant work force of 1200 people.

Q. Will the price structure remain the same?

A. There will be no change in price structure as a result of the purchase. Kaiser Aluminum will continue to be a leader in maintaining a stable price structure throughout the market.

Q. Can I now buy both aluminum and copper electrical conductor from Kaiser Aluminum?

A. Yes—and in a wider variety than formerly available from either source. One of the primary effects of the purchase is to broaden the product range offered by Kaiser Aluminum in both aluminum and copper conductors.

Q. How about the insulations used in U.S. Rubber products: will the quality still be the same?

A. These high-quality insulations will remain exactly the same in every specification detail. In fact, they will be *supplied* by U.S. Rubber. Continued research cooperation will exist between the U.S. Rubber scientists and engineers and Kaiser Aluminum.

your questions

U. S. Rubber Wire and Cable Division

Q. Will new people from both companies be calling on me?

A. There will be no duplication of calls, because former U.S. Rubber personnel will be prepared to present the entire, broadened product line to those customers who can benefit by it. Occasionally, Kaiser Aluminum specialists will accompany the former U.S. Rubber representatives to help present the complete line. Conversely, Kaiser Aluminum Sales Representatives will be prepared to present the new, complete line to their established customers, assisted by former U.S. Rubber specialists.

Q. I formerly bought through a Kaiser Aluminum or U.S. Rubber distributor outlet. How will this be changed?

A. The distributor who formerly carried U.S. Rubber wire and cable will continue to offer the same products with no change. Present Kaiser Aluminum Distributor outlets also will remain unchanged.

Q. Will there be any effect on the Field Engineering Services formerly available through either company?

A. The technical assistance available to you will be greatly increased. Kaiser Aluminum—as the nation's largest producer of covered aluminum wire—is already a leader in research and product development, both in the laboratory and in the field. Now, by acquiring additional highly skilled technical personnel, these services will be further strengthened.

Q. How will the new setup affect my delivery date?

A. The convenience of a new eastern plant location, plus additional sales representatives and distributors, will mean even faster and more efficient service.

* * *

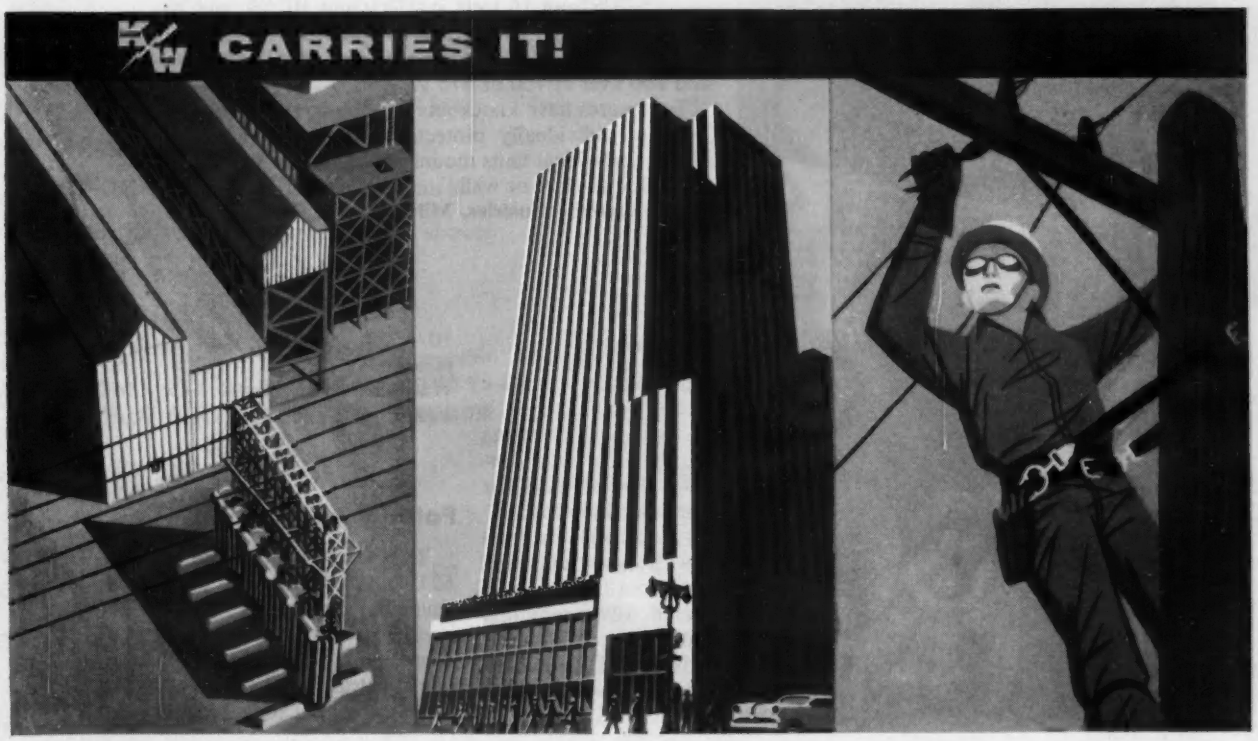
The purchase of the Wire and Cable Division of United States Rubber puts into operation the twenty-third plant for Kaiser Aluminum, which started with three plants just ten years ago.

This growth is based on the continued support of our customers, who, working with us, have helped to make Kaiser Aluminum the nation's fastest-growing major producer of aluminum. This latest acquisition represents another step forward in our program of complete service to the nation's rapidly-expanding electrical industry.

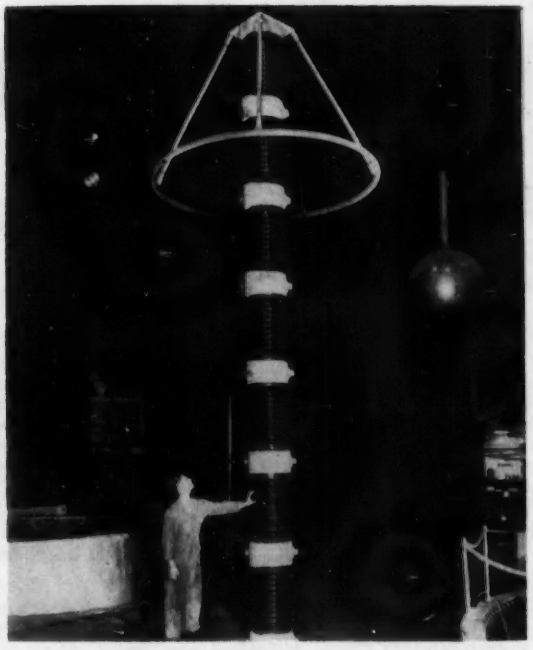
Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

Kaiser Aluminum

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.



NEW EQUIPMENT



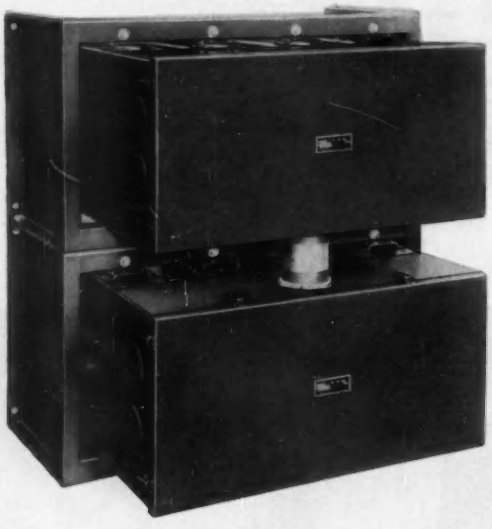
Lightning Arresters

These type SVS self-supporting lightning arresters, designed primarily for large substations, are available in ratings from 48 kv to 336 kv. Mounting on power transformers, they are said to need less mounting height and require no brackets or supporting structures.

Arrester columns are built-up of self-contained units. Three stacks of elements, arranged in a single porcelain housing, are in series electrically, in parallel physically. Manufacturer claims arresters of higher ratings can be assembled with fewer units.

Arresters have solder-sealed, porcelain-enclosed gaps, ceramic magnets in gaps, and standard pressure relief devices.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

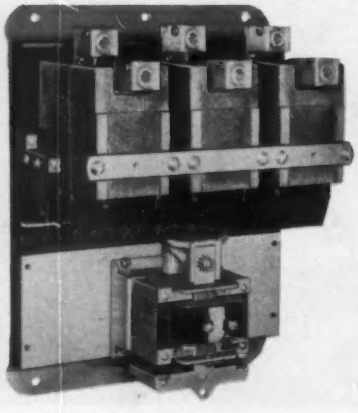


Dustproof Capacitors

Indoor, dustproof capacitors whose enclosures cover bushings, fuses, terminals, and connections are available in single and multiple units. Individual units are rated 5, 7.5, and 15 kvar at 230 v and 10, 15, and 20 kvar at 460 or 575 v. Multiple equipment ratings are: 30, 45, 60, 90, and 120 kvar at 230 v; 40, 60, 80, 120, and 160 kvar at 460 or 575 v.

Enclosures have knockouts on all four sides. Capacitors are individually protected by terminal mounted fuses. Individual units mount on wall, floor, or ceiling; multiples on floor or wall.

Line Material Industries, Milwaukee 1, Wis.



Solenoid Contactor

This 150-amp, NEMA size 4 a-c solenoid contactor is offered as a main-line, accelerating, or reversing contactor in motor starters and controllers. It may also be used for control of heater and lamp loads.

All stationary contacts are one-piece design, with heavy-duty lug accessible from front. Main contacts are sintered silver-cadmium oxide. Four side-mounted auxiliary contacts, NO, NC, or DT, are optional. Standard coil voltages are 110, 220, 400, or 550 v at 25 or 50/60 cps. Bulletin 4454 has complete data.

Ward-Leonard Electric Co, Mt. Vernon, N. Y.

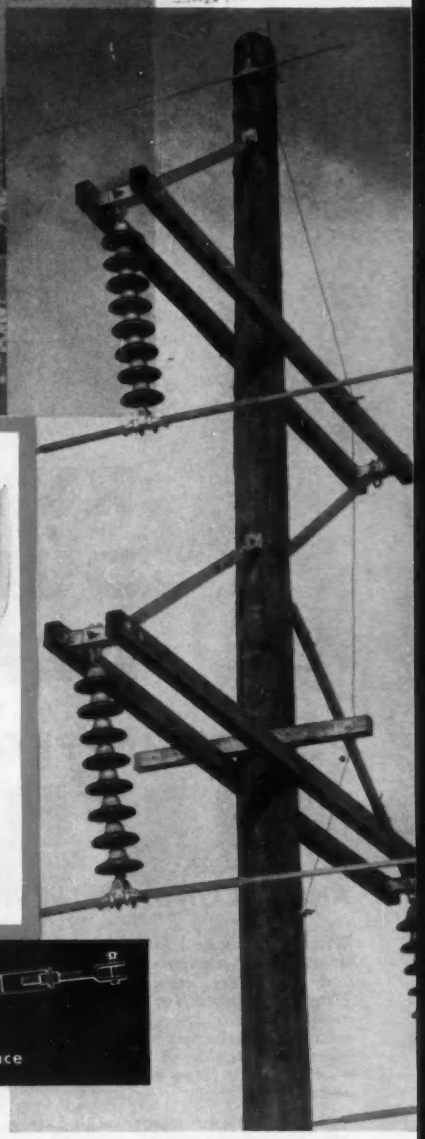
Potting Resins

Two epoxy potting resins, No. 621 and No. 623, are offered for embedding transformers, coil windings, transistors, and other electrical components. The resins are said to offer heat and shock resistance and

(Continued on page 128)

138 kv Line of new design using Joslyn Heavy-Duty Adjustable Spacer Fittings and Adjustable Strain Braces—another Joslyn first.

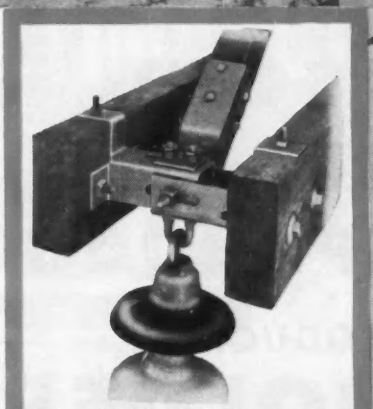
Joslyn adjustable spacer fittings



A JOSLYN FIRST

Joslyn has designed and produced Adjustable Spacer Fittings for four years. To meet the need for a heavy-duty adjustable fitting with bracing attachment, Joslyn pioneered the design shown in these photographs.

SIMPLIFIES CONSTRUCTION——— FOR ALL TYPES OF HEAVY-DUTY DOUBLE PLANK ARM STRUCTURES.



Joslyn J6120* Adjustable Spacer Fitting adjusts easily from 8 to 12 inches by removing only one bolt. Fitting is not taken apart—slides or telescopes when adjustments are required. Completely static proof.

Adjustable Strain Brace

*Patent Applied For

Eliminates need for gained poles, shims or other devices to compensate for varying pole diameters.

JOSLYN COMPLETE POLE LINE EQUIPMENT

JOSLYN MFG. AND SUPPLY CO.

155 North Wacker Drive
Chicago 6, Illinois

Smooth "Pulley Action" Wireway Prevents Conductor Chafing
Extra-Sturdy Copper Rivet
Large 1" x 7/8" Hole
Heavy Steel Cup-Base and Yoke A Single Hot Dipped Galvanized Steel Stamping
Two Holes in Base Assure Effective Drainage
No. 22 X 2¼" Hot Dipped Galvanized Screw Assembled Solidly and Rigidly to Steel Base
Extra Sharp Threads and Quick-Starting Point Make Driving Easy

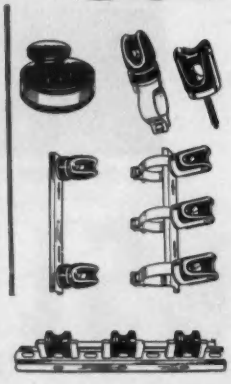
RUGGED DURABLE DEPENDABLE

PORCELAIN PRODUCTS WIREHOLDERS

AND SECONDARY SERVICE MATERIALS

Where *quality* and *performance* are necessary for continuous line service—Porcelain Products wireholders and secondary service materials *assure* reliability. They're engineered with strong, sturdy construction—metal in tension, porcelain in compression. Steel parts are hot-dip galvanized . . . screw threads are extra sharp, lubricated for ease of installation. Larger, pulley-action wire hole, for large wire sizes—prevents chafing, wire wear.

These EXTRA features—*plus*—Porcelain Products "Quality Line" reputation, make an unbeatable combination . . . SPECIFY PORCELAIN PRODUCTS wireholders and secondary service materials.

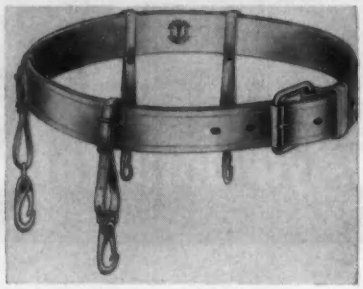


63 Years Porcelain Products, Inc. PP INC.
FINDLAY, OHIO

Potting Resins

(Continued from page 126)

create a hermetic seal which is impervious to water, chemicals, and contaminants. Both compounds are reported to have high dielectric strength and to adhere firmly to metals and ceramics without adverse effects on nearby materials. Manufacturer claims either can be oven-cured in a few hours when mixed with appropriate hardeners. A bulletin provides further information and working instructions.
Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.



Waist Belt Supporter

This waist belt supporter has four-point suspension with four separate snaps, each provided with a buckle for easy adjustment. Available in sizes 36 to 46 in. Catalog No. 5208 gives additional data.
Mathias Klein & Sons, Chicago, Ill.

Trench Digger

The Pow-R Spade trench digger is reported to dig a 3-in. wide trench at any depth to 24-in. Removable cutting blades are said to be self-

(Continued on page 130)

A mica part is like any other kind of part that goes into an assembly.

Speed of assembly depends very much upon uniformity of parts.

Mica parts, produced by Macallen from Macallen Mica, are accurate and uniform — they speed production.

When you specify Mica, go all the way and specify

MACALLEN MICA
THE ULTIMATE IN MICA

THE ULTIMATE IN MICA

send for Catalog

THE MACALLEN COMPANY

BAY ROAD
NEWMARKET, NEW HAMPSHIRE

CHICAGO: 565 W. WASHINGTON BLVD.
CLEVELAND: 1231 SUPERIOR AVE.

What Makes RT&E Transformers Better?

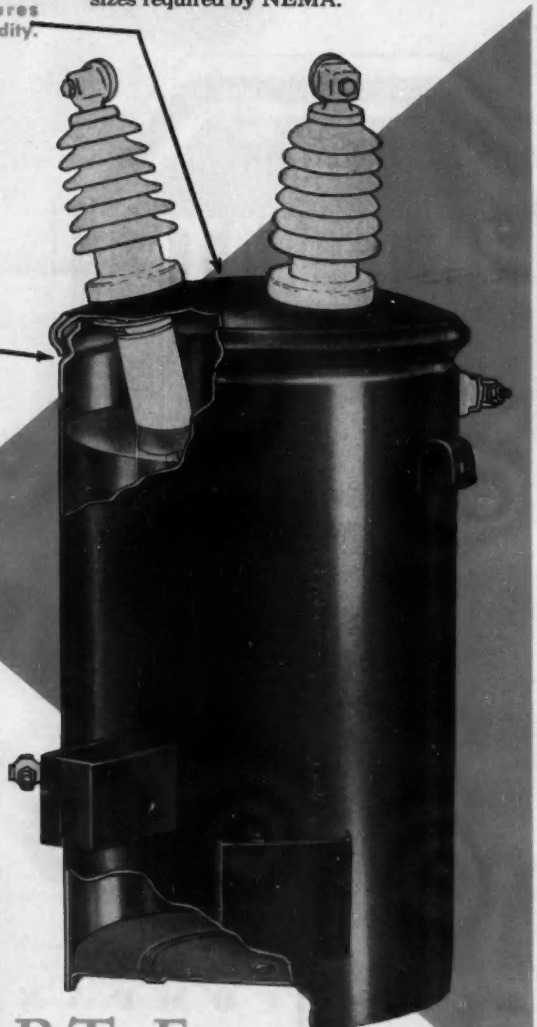
SUPERIOR TANK CONSTRUCTION
for longer Trouble-free life

RT&E tanks get three coats of modified alkyd paint — two coats flowed on, final coat sprayed — and each coat individually baked. This thoroughness provides the highest type of weather resistance. Arc welding of all seams, brackets and mounting pads, eliminates moisture traps and corrosion.

These heavy gauge steel tanks, with circular grooved bottoms, assure extra strength. Tin plated, locked type terminals accommodate either copper or aluminum conductor in the full range at sizes required by NEMA.

Domed cover assures water run-off and rigidity.

Preformed gasket surfaces in both tank and cover assures tight gasket seal.



RT&E Transformers are available from conveniently located warehouses throughout the nation. These dependable units are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

SUPERIOR TANK CONSTRUCTION — *Another reason why* RT&E *is better.*

Trench Digger

(Continued from page 128)

cleaning. Manufacturer claims it can be operated, and transported from one location to another by one man. Powered by a 4-cycle engine. **Stampings, Inc, 1017 Mound St, Davenport, Iowa.**

Utility Truck Doors

The extruded aluminum rolling doors installed on the service truck shown above are said to contribute to compact design and easy access to tool and equipment compartments. They extend the full length of the body on each side. Doors are counterbalanced for ease in rolling, and are made of aluminum slats $1\frac{5}{16}$ in. wide that interlock for protection against water and weather. "Aluminited" finish is reportedly corrosion resistant and is said to obviate painting and other maintenance operations. **Cookson Co, 1525 Cortland Ave, San Francisco 10, Calif.**

Precipitator Regulator

The CA precipitator control system is reported to adjust voltage and power input in electrostatic gas cleaning systems continuously and instantaneously to maintain the optimum spark rate despite changes in temperature, humidity, composition, flow rate, particle size or particle resistivity. The manufacturer claims this control enables the precipitator to operate 24 hr a day at maximum efficiency without requiring highly skilled operators.

The system uses a feedback loop to compare actual voltage, current, and sparking conditions with pre-set reference levels. A control unit uses the difference signal to adjust the rectifier output. The self-contained

(Continued on page 134)

UTILITIES EXPECT MORE FROM POWERS American

Series 350
SERVICE-MAINTENANCE BODY
HANDLES 3 JOBS

Series 450
MAINTENANCE AND CONSTRUCTION BODY
Another unique design, ideal for municipalities!

DUAL PERFORMANCE . . .

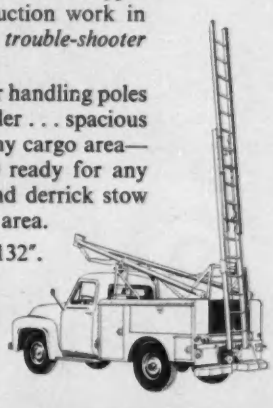
- Revolving aerial ladder for overhead work—revolves 360°—furnished in a height best suited to your needs.
- Underslung winch permits use of derrick—for handling 35′ poles—without interference to aerial ladder.

The Series 450 is available in 108″ and 132″ length.

This extremely versatile body will handle all types of service, maintenance, and construction work in small operations . . . and is an ideal *trouble-shooter* for larger utilites.

An easily-erected fold-over derrick for handling poles up to 35′ . . . a 24′ extension ladder . . . spacious bin-equipped compartments . . . roomy cargo area—all combine to make the Series 350 ready for any job at a moment's notice. Ladder and derrick stow above body . . . never obstruct cargo area.

In four lengths—84″, 90″, 104″, and 132″.



Get complete details and price information. Send for Powers-American Series 350 Bulletin #109R or Series 450 Bulletin #118 *today*.

McCABE-POWERS AUTO BODY COMPANY

5900 NO. BROADWAY • ST. LOUIS 15, MO. • 625 CEDAR ST. • BERKELEY 10, CALIF.

3 reasons why

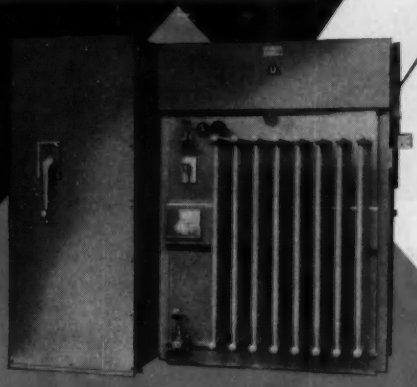
UPTEGRAFF

1. Reliability

They know Uptegraff transformers are top quality . . . fully guaranteed . . . meet ASA, NEMA and AIEE standards . . . have a proven record of superior performance . . . have been designed and manufactured by Uptegraff for over 30 years.

Up to 10,000 KVA—all top quality.

Uptegraff Power Transformers are made for either power transmission and distribution or for industrial power utilization.



Load center-liquid and dry type.

Designed for location at center of load. Liquid filled—oil or askarel. Dry type —Class B or Class H insulation.

Large stock of dry type lighting transformers.

For serving almost any lighting application. Available from stock in sizes ranging up to 150 KVA.

Before specifying electrical equipment for new or expansion of existing systems, see this helpful engineering data, described in the coupon.

many companies select

TRANSFORMERS

2. Versatility

They know that Uptegraff transformers are available in a wide range of sizes and types . . . and that Uptegraff has engineering and manufacturing facilities to provide special types for exact customer requirements.

3. Dependable Delivery

They have found that Uptegraff service is prompt and efficient . . . unnecessary delay is eliminated . . . the people of Uptegraff are vitally and personally interested in serving their needs.

That's why more and more companies are standardizing on Uptegraff transformers. They like the top-quality performance, long life and low over-all cost . . . as well as the personal and efficient service.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

Overhead and station-type distribution.
Made in various sizes from 3 to 500 KVA and for a wide range of applications. Conforms to latest EEI and NEMA proposed standards.

Mail Coupon Today!

FOR FREE ENGINEERING DATA

Attach coupon to company letterhead. Our Engineers welcome inquiries on any of your requirements—standard or special.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

Gentlemen: Please send available literature on

Power Transformers ☐ Load Center Transformers ☐
Lighting Transformers ☐
Station-Type Distribution Transformers ☐
Overhead Distribution Transformers ☐

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Network transformers.
Conventional and submersible types. Designed and manufactured for standard or special requirements.

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

Mr. Contractor...
HUSKY Service Drawings* cuts down Labor Costs

- We make field erection a simple assembly job.
- We can make take off layouts from drawings furnished by you.
- We eliminate guess work with our service drawings.
- We guarantee our detailed layout on basis of drawings furnished by you.
- NO OTHER MANUFACTURER OFFERS SUCH SERVICE.

ONLY HUSKY OFFERS YOU

- Detailed Service Drawings
- Greatest Length
- Fewer Pieces to Handle

Don't COMPARE MATERIAL COST

Do COMPARE INSTALLED COST

* Small service fee on small jobs. FREE on large jobs.

Design and layout assistance available. Unit responsibility assumed. Over 3000 completed installations — Send for free catalog.

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.

5300 VINE STREET, CINCINNATI 17, OHIO

Precipitator Regulator

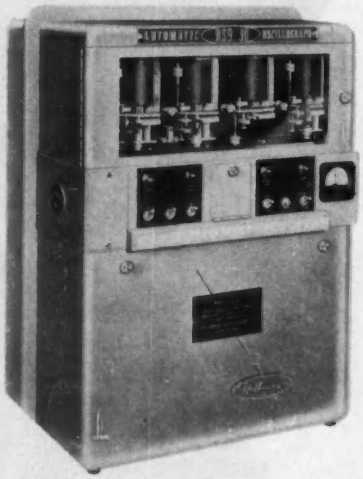
(Continued from page 130)

units can be installed on or near the precipitator. Units are made of replaceable subassemblies for ease in replacement and maintenance.

Research - Cottrell Inc., Bound Brook, N. J.

Automatic Oscillographs

The RS9-14 and RS9-30 automatic oscillographs are said to be designed specifically to record magnitude and duration of faults and transients. They also record synchronizing power and relay and breaker operation. They are reported to reach full recording speed two milliseconds after the starting relays trip.



A combination of relays monitors both station and system operation. These instruments are panel mounting with electrical connections at the rear and hinged access doors for maintenance and adjustment.

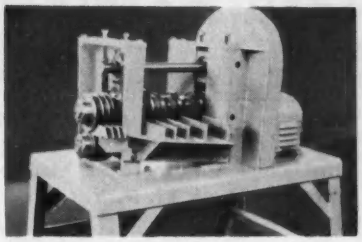
The RS9-14 handles up to 14 channels on a 10-in. chart, has individually adjustable recording beams, magazine loading, and a calibrated viewing screen. The RS9-30 accommodates 30 channels on a 12-in. chart, has cartridge loading and a focal plane calibrating screen. Bulletins 1-20 and 1-21 give further data.

Hathaway Instrument Div., Hamilton Watch Co., 5800 E. Jewell Ave., Denver, Colo.

Induction Heater

This 400-cps induction heater reportedly permits weldments to be preheated or stress relieved without being moved from the welding area. A strip chart proportional program recorder, adjustable for any schedule of heating, soaking and cooling rates, can provide continuous, fully automatic control of temperature during processing and produce a record of the entire operation.

The 400-cps unit comes up to temperature faster than 60-cps models and uses less current. As a result, smaller diameter wire with less ampere-turns can be used, reducing necessity for water-cooling. **Hobart Brothers Co., Troy, Ohio.**



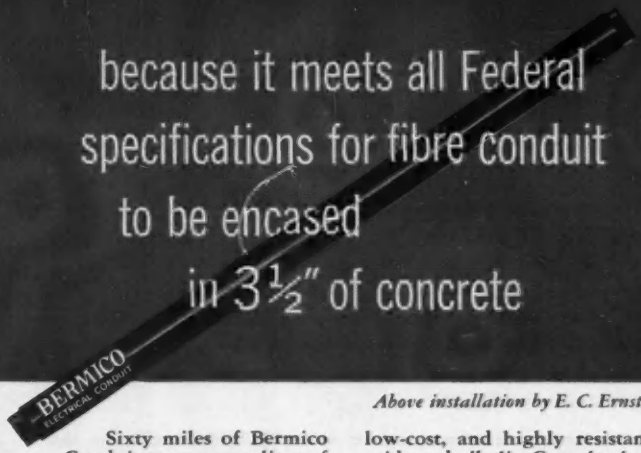
Cable Stripper

This model 306-S motor-driven cable stripper is reported to remove lead, braid, rubber, neoprene, vinyl, or thermoplastic coverings from a wide range of copper and aluminum cables. Seven sets of rotary feeder and cutter units, each self-adjusting within its range, accommodate O.D.'s between 0.25 and 3.5 in. **Greenberg Engineering Co., 1004 Bankers Securities Bldg., Philadelphia 7, Pa.**

(More New Equipment on page 136)

BERMICO® electrical conduit
used at Norfolk Naval Air Station...

because it meets all Federal specifications for fibre conduit to be encased in 3½" of concrete



Above installation by E. C. Ernst, Inc.

Sixty miles of Bermico Conduit carry power lines of up to 34,000 volts as well as signal lines for communications and supervisory systems at the U.S. Naval Air Station, Norfolk, Va.

Precision engineered Bermico Conduit is made to exacting specifications from cellulose impregnated with pitch. It is strong, light, low-cost, and highly resistant to acids and alkalis. Completely uniform, it installs quickly and easily.

Bermico Conduit is specified by leading electrical contractors and by public utilities from coast to coast. To speed your cable installations . . . specify Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electrical Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
General Sales Office: 150 Causeway Street, Boston 14, Mass.

TURN MINUTES INTO YEARS OF Protection at the vital points of overhead conductors

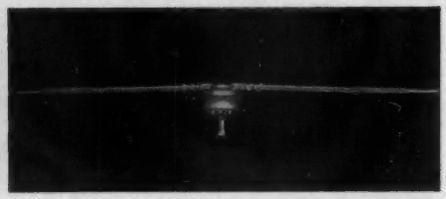
Fine FANNER

SUPERFORMED ARMOR RODS

are easily applied . . . provide positive full-length grip and absolute uniformity of application

Fine Fanner SUPERFORMED Armor Rods offer the economical way for positive, lasting protection of overhead transmission and distribution lines. Their INSTALLED cost is so small compared with the service failures they prevent, it pays to install them at all points where vibration damage is likely to occur.*

Armor rods are easy to apply.



Completed armor rod installation.

Whenever you need accessory items for overhead conductors you'll do far better by standardizing on fine Fanner SUPERFORMED products. Each product in the Fanner SUPERFORMED line is carefully engineered and accurately manufactured. Highest quality materials provide long service life. Special packaging insures safe delivery and protection in storage. With all their extra features, Fanner SUPERFORMED products cost no more than ordinary products.

Armor rods and other products in the SUPERFORMED line are fully described in current literature. Write today for your copy.

*Where spans are short and tensions low, use Fanner SUPERFORMED lineguards.

Licensed for use under patent No. 2,275,019.

THE FANNER MANUFACTURING CO.

Electrical Products Division

BROOKSIDE PARK • Established 1894 • CLEVELAND 9, OHIO

Telephone: SHadyside 1-6000

Fine Fanner Superformed

AGENTS AND DISTRIBUTORS IN PRINCIPAL CITIES

TAP ARMOR | PLASTIC FANNGUARDS | PATCH RODS | FANNGRIPS

Electronic Proximity Control

This model MEK-3030 proximity control is said to be useful as a limit switch, a fluid level control, a fluid interface control, or in similar applications where physical contact with the moving surface is undesirable.

The unit contains a 115-v, 5-amp. plug-in relay with visible, spdt contacts. Power requirements are 25 va from a 115-v, 60-cps line. As the surface nears the detecting element, it changes the loading in a high frequency circuit. Different types of detecting elements are available for different applications. **Machinery Electrification, Inc., Northboro, Mass.**

Reflector

Hibay No. 640 is a prismatic reflector for 400-w mercury vapor lamps. Reported efficiency is 48 to 56% in the zero to 30F zone. Socket is ventilated for cool operation and can be installed and wired separately from the reflector. Design is said to keep reflector clean. **Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y.**

Air Cleaner

Electronic air cleaners for home and small commercial use are available in 8 models, with capacities ranging from 1,000 to 9,600 cfm. Power pack may be located remotely from the cleaner for ease in maintenance. Reported minimum efficiency is 90% and particles as small as 1/2,500,000-in. thick can be removed.
Trion, Inc, Pittsburgh, Pa.

(More New Equipment on page 138)

electrical wonder rubber OFFERS TRIPLE VALUE

Performance! Versatility! Economy! In all three, Enjay Butyl is the world's outstanding rubber value. In a wide variety of applications, Enjay Butyl rubber stands *unmatched* in its ability to resist ozone and corona, impact and abrasion, moisture and weathering . . . properties that contribute to the *outstanding* performance of Butyl-made products.

Instrument transformers, underground service cables, high voltage industrial cables . . . in these, and many other electrical applications, Enjay Butyl out-performs and out-lasts *all other* types of rubber, synthetic *or* natural. *Low-in-cost* and *immediately available*, this truly wonder rubber may well be able to cut costs and improve performance in *your* products. For further information, and for expert technical assistance, contact the Enjay Company.

ENJAY

Pioneer in Petrochemicals

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Chicago • Los Angeles • New Orleans • Tulsa

ENJAY BUTYL

Enjay Butyl is the greatest rubber value in the world . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

New Model YLW-96 Body with Hydraulic Derrick and Digger by YORK-HOOVER

INVEST IN THE YORK-HOOVER YLW-96 FOR SERVICE ECONOMY

DESIGNED FOR 2 MAN OPERATION

FAST OPERATING DERRICK AND DIGGER

DERRICK EQUIPMENT HANDLES 45′ POLES

A completely equipped line body with hydraulic derrick and digger located for either front or rear operation.
The hydraulic derrick has been "field proven" with hundreds in daily operation. It incorporates the expanding center leg principal with lifting capacity limited only by the chassis stability.
A pressure type hydraulic digger designed to work in those "hard to get at" places, stows with the derrick when not in use.
Modern—proven—efficient—get the complete story on the York-Hoover YLW-96 unit.

BODY DIVISION
YORK-HOOVER CORPORATION
YORK, PENNSYLVANIA

Write for Bulletin No. 941 Today!

Creative Engineering for the Public Utility Industry Since 1892

MORE NEW PRODUCTS

Thor Power Tool Co, 181 N. St, Aurora, Ill., offers two 1.5-kw models of a vertical shaft portable **electric generator.** Model EG-1.5A is for ac, model EG-1.5D for dc. Each provides 13 amp at 115 v, weighs 95 lbs.

Diamond Calk Horseshoe Co, Duluth, Minn., has available two long reach solid joint **pliers;** model DB-58, an 8-in. duck bill plier and model NN-58, an 8-in. needlenose.

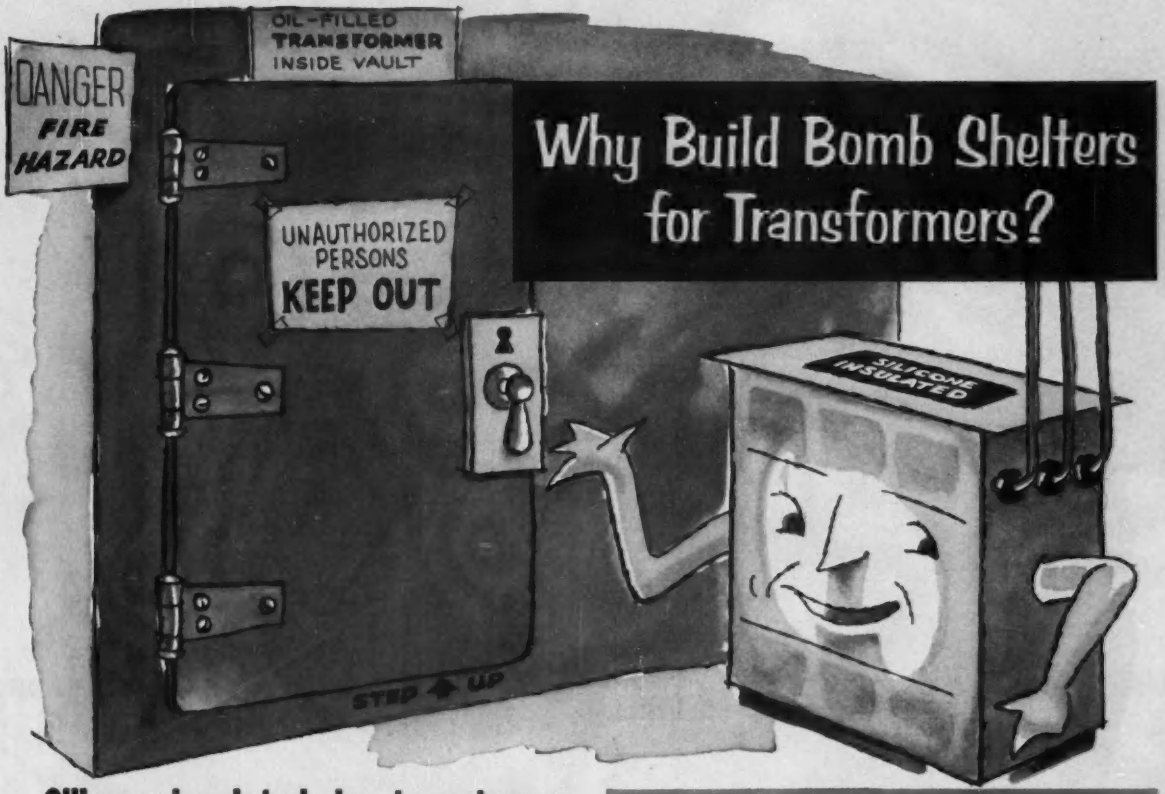
Nuclear Measurements Corp, 2460 N. Arlington Ave, Indianapolis 18, Ind., has a Nucliguard **area-personnel-equipment monitor** for detecting changes in radioactivity level. Has a built-in, precalibrated radioactive sample and a 3,600-cps test signal. Available with beta-gamma sensitive GM probe or gamma sensitive scintillation probe.

Hanson-Gorrill-Brian, Inc, 85 Hazel St, Glen Cove, N. Y., has a **multi-channel simultaneous data system** which receives analog inputs from any number of primary sensing elements and present decimal digital data on all channels simultaneously.

General Switch Co, 45 Roebling Street, Brooklyn 11, N. Y., announces the redesign of two groups of fusible residential 100-amp multiple **disconnect panels** which provide 220-v service disconnects for three or four appliances as well as several 110-v plug fuse branches. They are numbered in General's catalog as follows: 963-104, 963-106, 963-108, 9698, 96910, and 96912. 250-v dc service.

Sperry Products, Inc, Danbury, Conn., has an electronic **bearing tester** to detect and measure wear in bearings, gears, spindles or slides without disassembling the machine.

Bodine Electric Co, 2254 W Ohio St, Chicago 12, Ill. has a type U split-phase **induction motor** for office machines, blowers, pumps, and coin handling machines. Rated 1/30 hp at 1125 rpm, and 1/20 and 1/15 hp at 1725 rpm.



Why Build Bomb Shelters for Transformers?

Silicone insulated dry-type transformers need no vaults, are safer, more reliable and less expensive.

SAFER . . . no explosion, fire or toxic hazards with silicone insulation.

MORE RELIABLE . . . silicone insulation is inherently more resistant to high ambients, heavy overloads, moisture and corrosive atmospheres.

LESS COSTLY . . . silicone insulation can harness more power per pound. That means smaller transformers that can be installed close to load anywhere in your plant saving space, copper and installation costs.

. . . your power distribution system is more efficient, more flexible and adaptable with silicone insulated dry-type transformers.

. . . silicone insulated dry-type transformers require no expensive vaults or special ventilating systems.

. . . your maintenance costs drop to almost nothing with silicone insulated dry-type transformers. All that's required is an occasional dusting — no liquids to replace or filter.

Mail coupon today for additional information.

Dow Corning Corporation, Dept. 4415, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

DOW CORNING SILICONES

pt your proof of reliability

Where is there a more vital need for reliable transformer service than in a major commercial airport? The greater Fort Worth International Air Port uses two Pennsylvania Transformer Company units, both 1000 KVA, three phase, 60 cycles, 150 C rise. Insulated with Dow Corning Silicones, these dry-type transformers carry all power for Fort Worth's field and terminal lighting system. Silicone insulation was specified because it provides a greater guarantee to public safety; is more dependable, and has the overload capacity to handle emergency loads.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.

CANADA: Dow Corning Silicones Ltd., Toronto
GREAT BRITAIN: Midland Silicones Ltd., London
FRANCE: St. Gobain, Paris

D. B. LAWTON, General Manager of General Electric's Medium Transformer Department, is shown with a model of the standard-design RM transformer. These transformers are manufactured in General Electric's $25,000,000 facilities in Rome, Georgia.

A GENERAL ELECTRIC 10-YEAR FORECAST:

$40,000,000 electric utility savings with medium transformer standardization

Based on today's eight percent lower price of standard ratings compared with specials, America's electric utilities stand to save—in the next 10 years—more than $40,000,000 on medium transformers (501 to 7500 kva, 69 kv and below). So forecasts D. B. Lawton, General Manager of General Electric's Medium Transformer Department, Rome, Georgia.

This $40,000,000 savings figure is conservative. Based on present standard-versus-special buying practice, it will be greatly exceeded if the utility industry continues to increase its acceptance of standards as in the past few years.

The tremendous saving due to lower prices is but one of the many benefits of medium transformer standardization. The modern, repetitive manufacturing facility put in place by General Electric at Rome in 1953 also makes possible:

Faster shipment—Ten-week shipment is now average for General Electric RM medium transformers. This compares with an industry average of more than 16 weeks for specials.

*Reg. Trade-mark of General Electric Company

More and better features—Standard design has made it economically possible for General Electric to offer such important extras as Formex* insulated windings, control-center arrangement of instruments and accessories, reversible junction boxes, full drain, and many others.

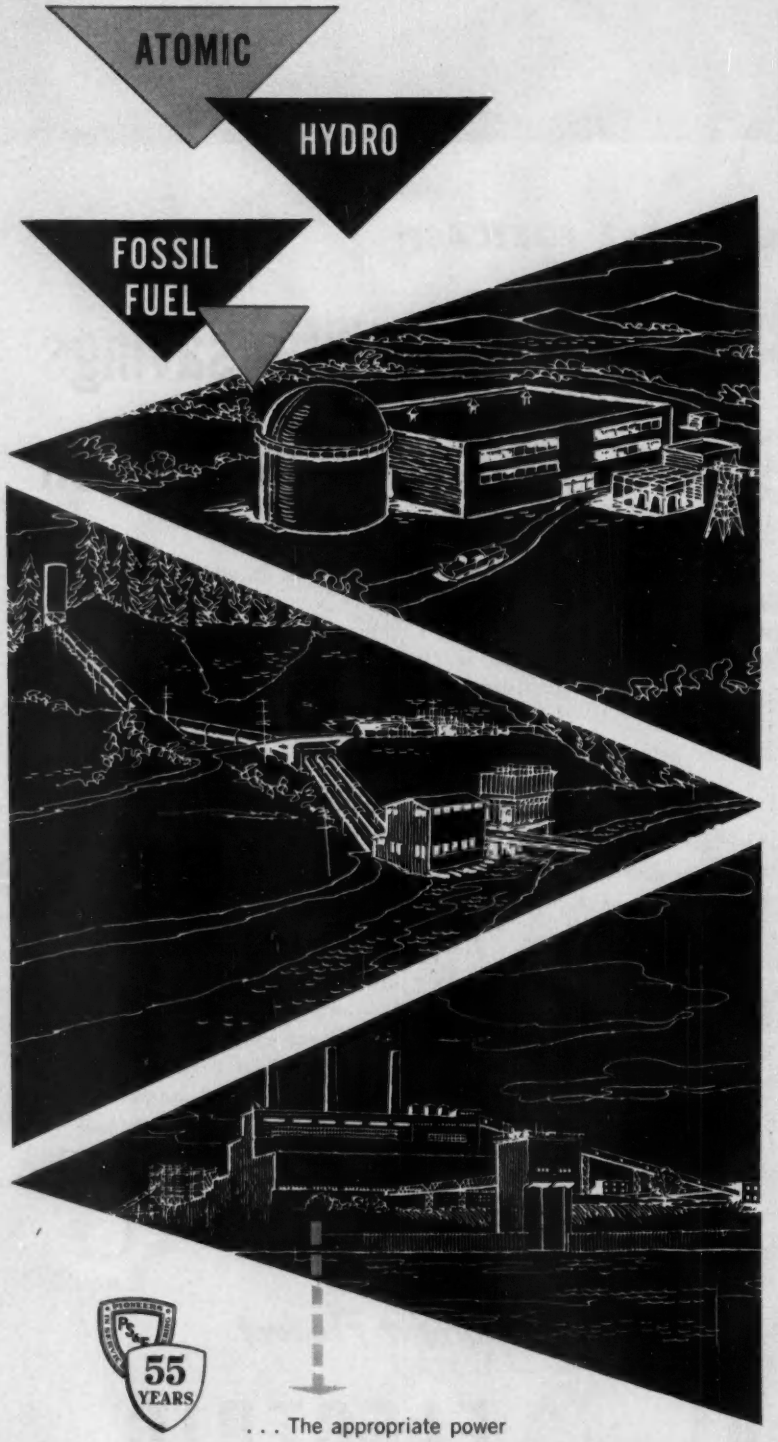
Higher quality for longer life—General Electric repetitive manufacture techniques permit 18 assembly-line tests and 22 quality control inspections during manufacture, to assure dependable operation over a long service life.

G.E.'S BROAD RANGE OF STANDARDS HANDLES 90% OF ALL JOBS

If your company is not yet taking full advantage of the large dollar savings and other key benefits of medium transformer standardization, act today. Ask your G-E Apparatus Sales Engineer to show you how G.E.'s broad range of standard RM medium transformers can meet the large bulk of your needs, work efficiently with older, special transformers now on your system. General Electric Company, Schenectady 5, New York. 416-7

Progress Is Our Most Important Product

GENERAL ELECTRIC



55 YEARS

. . . The appropriate power
for your expanding program

Send for our descriptive booklet, "Pioneering New Horizons" of these and other services.

Pioneer Service & Engineering Co.
231 South La Salle Street • Chicago, Illinois

CATALOGS—BULLETINS

• **OIL PURIFIERS:** Bulletin 10-107 describes centrifugal oil purifiers manufactured by De Laval Separator Co, Poughkeepsie, N. Y.

• **MISCELLANEOUS:** The publications listed below have been published recently by General Electric Co. The address is Schenectady 5, N. Y., unless otherwise indicated:

NEMA Class E-1 high voltage starter for motor control systems up to 50,000 kva without power fuses is discussed in GEA-6451.

DC Magnet Brake is covered in 8-page bulletin GEA-6214, giving simplified installation and maintenance procedures.

Plate-type rheostats is the subject of GEA-6474. Publication gives selection information, outstanding features, etc.

Current-limiting reactors, their design and application date are covered in booklet No. GEA-976-D. RM cast-in-concrete reactors for circuits of 34.5 kv and below are covered.

Industrial locomotives is the subject of the second in a series of publications for users of industrial haulage equipment. Ask for No. GEA-6332.

Permanent magnets, Thermistors and Varistors are the subjects of a booklet entitled, "Trends and Developments for Electrical Design Engineers", released by GE's Metallurgical Products Dept, Detroit 32, Mich.

Indoor oil circuit breakers are described in GEA-6465.

"Guide to Metal-Clad Switchgear Maintenance" is the name of an 8-page publication which outlines a product maintenance program for medium-voltage, metal-clad switchgear and air-magnetic and oil-filled types of power circuit breakers. Designated GER-1282.

1957 Meter Buyers' Guide, GEC-1400, 64 pages, covers all essential information on GE's single-phase, polyphase and watthour demand meters, as well as water heater time switches and meter sockets.

• **UNDERWRITERS' LAB BOOKS:** The following two books are available from Underwriters' Laboratories, Inc, at any of these addresses: 207 E. Ohio St, Chicago 11, Ill.; 161 Sixth Avenue, New York 13, N. Y.; 1655 Scott Lane, Santa Clara, Calif:

Bi-Monthly Supplement to the lists of Accident Equipment; Automotive Equipment; Burglary Protection Equipment; Electrical Appliance and Utilization Equipment; Electrical Construction Materials; Hazardous Location Equipment; Fire Protection Equipment; and Gas and Oil Equipment.

Fire Protection Equipment List, January, 1957, containing summaries of reports on appliances and materials which have been examined primarily with reference to fire preventive and protective capabilities.

• **'AIRCOMATIC' CUTTING:** Development applications of Aircomatic Cutting, a method for straight-line and shape cutting of non-ferrous metals, are described in detail in a 24-page informational pamphlet. The method is said to be particularly applicable for high-speed cutting by gas-shielded arc welding. Write Air Reduction Sales Co, 150 E. 42nd Street, New York 17, N. Y.

(*More Catalogs on page* 144)

low-cost AND dependable

through countless operations

KEARNEY
TRIP-O-LINK FUSE CUTOUTS

Regardless of length of service or number of operations, the dependable Trip-O-Link, with its replaceable cartridge and fuse, *continues* to extinguish the arc in less than one cycle.

Mechanical energy of short circuits is dissipated through low mass, flexible cutout arms which do not resist the impact, but *flex with it.* Since the shock is not transmitted to the insulator, Trip-O-Links make countless operations without suffering mechanical damage.

A patented feature of Trip-O-Link Fuse Links combines fusible element, fibre bakelite cartridge and leaders into a single, easily handled unit, providing a new arc quenching cartridge every time the cutout operates within its rating. Trip-O-Links are easiest of all cutouts to re-fuse.

JAMES R. KEARNEY CORPORATION

General Offices

4224-42 Clayton Avenue • St. Louis 10, Missouri

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for BETTER CONSTRUCTION
SAFER MAINTENANCE

Specify JAMES R. KEARNEY *The Mark of Quality*

KEARNEY PRODUCTS

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IOWA—GUELPH, ONT., CANADA

COPE EXPANDED METAL CABLE TROUGH THE LOWEST INSTALLED COST OF ANY CABLE SUPPORTING SYSTEM

Cope Expanded Metal Cable Trough is installed in 90% of all major U. S. utilities and is used widely throughout industry.

Note these advantages that are unique with Cope Expanded Metal Cable Trough:

Labor Savings. Quick, simple connections mean faster installation, reduced labor costs. Exclusive Cope Pin-Type Coupler uses only two steel pins and a bottom plate per connection.

Materials Savings. Since far less steel is required than for most types of supporting systems, you save quantities of steel. And fewer, lighter supports are needed.

Improved Electrical Properties. Cope Expanded Metal Cable Trough allows higher cable current ratings. Some engineers allow free air ratings, and all allow higher ratings than are permitted with a solid, enclosed support.

Maintenance Savings. Cable is available for inspection and repair when it is laid in Trough. Insulation is saved by allowing the generated heat to escape and also by greatly reducing frictional wear when cable is installed.

Greater Flexibility. Cope Trough is the most flexible system of cable supports ever designed. A complete line of standard fittings simplifies side runs, drop-outs, last minute changes, plant expansions.

Space Savings. Cope Trough saves space by reducing materials. Confusion is reduced during installation because connections are simpler.

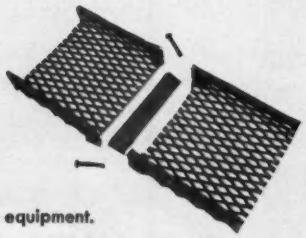
Other Cope Products to Help Simplify Your Jobs:

Cope Cable Ladder is the simplest and least costly system for the support of armored and other semi-rigid cables.

Cope Cable Channel for branch runs is readily tied in with Trough or Ladder System. Both Ladder and Channel incorporate exclusive Pin-Type Coupler.

Cope Rakit Supports are designed specifically for the support of Cope Ladder, Channel, and Trough Systems. Available either with trapeze or the more popular cantilever supports.

EXCLUSIVE COPE PIN-TYPE COUPLER greatly simplifies installations, reduces installation costs, and provides greater adaptability. Pin is driven into interlocking barrels and rigidly secures the connections. Bottom plate protects cable at Trough connections.



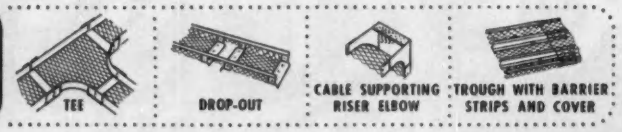
Cope Standard Line is a complete line of underground cable installation equipment.

Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

T. J. COPE, INC.

COLLEGEVILLE 4, PENNSYLVANIA

Cope



Catalogs & Bulletins

(*Continued from page* 142)

● **CONTROLS:** The below listed publications have been published recently by Minneapolis-Honeywell Regulator Co, Industrial Division, Philadelphia 44, Pa:

Brown Non-Indicating Pneumatic Pressure Transmitter for vacuum or pressure measurement is described in Specification S705-1.

Brown Small-Case Indicating Pneumatic Controllers for temperature and pressure are covered in Specification Catalog C $\frac{600}{700}$ 1.

Spring-Loaded Thermocouples are the subject of Specification S001-6.

Sostman Motion Transducers, and their use with any Brown ElectroniK instrument wherever linear or angular motion must be measured, are described in Instrumentation Data Sheet 10/18-12.

● **COMPUTER:** A 6-page illustrated catalog on the Bendix G-15D general purpose digital computer and its digital differential analyzer accessory is available from Bendix Computer Division, Bendix Aviation Corp, 5630 Arbor Vitae Street, Los Angeles 45, Calif.

● **MAGNETIC SHIELDING:** Technical bulletin No. 122 describes the advantages and methods of fabricating non-shock sensitive, non-retentive Fernetic Co-Netic magnetic shielding material in a customer's plant. Write Magnetic Shield Div, Perfection Mica Co, 20 N. Wacker Drive, Chicago 6, Ill.

● **MISCELLANEOUS:** A 38-page catalog describing its portable electric plants, self-priming centrifugal and diaphragm pumps, "Hole-A-Matic" earth-boring equipment and 2-way flasher lights has been issued by Gen-A-Matic Corp, 14741 Bessemer Street, Van Nuys, Calif.

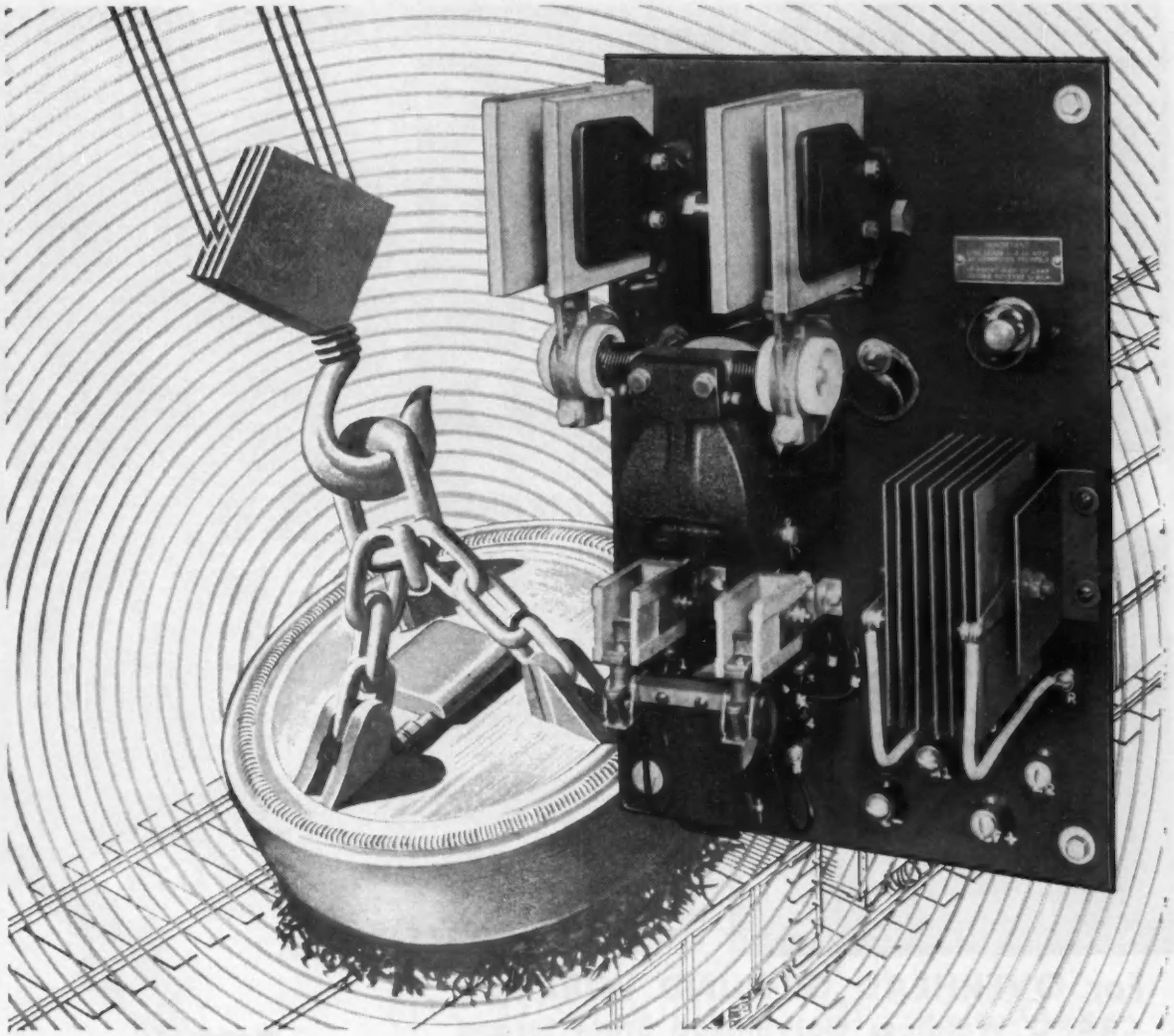
● **TEMPERATURE CONTROL SYSTEMS FOR SCHOOLS:** A 16-page catalog, written in non-technical language, describes the electric temperature control systems for heating and air conditioning modern schools, colleges and institutional buildings, manufactured by Barber-Colman Co, Rockford, Ill.

● **LIGHTING STANDARDS:** Its line of lighting standards and its illuminating engineering services are covered in Catalog No. 55 issued by the firm of William A. Daunt, 110 E. 42nd Street, New York, N. Y.

● **CORROSION RESISTANCE:** "Corrosion Resistance of Chromallized Iron and Steel Parts" is the title of an 8-page booklet that covers what its title implies. Published by Chromalloy Corp, 450 Tarrytown Road, White Plains, N. Y.

● **WIRING RACEWAYS:** Bulletin S-301 outlines methods for simplifying wiring operations from the drafting room to the assembly floor by using raceways and pre-cut wires. Text and pictures describe installation procedures. Available upon request from Stahlin Brothers, Inc, 336 Maple Street, Belding, Mich.

● **FLAT-TYPE MOTORS:** Illustrated Bulletin No. 3461 describes the line of flat-type motors for the machine tool and original equipment industries that are manufactured by Diehl Mfg Co, Somerville, N. J.



Ohio Electric Manufacturing Co. guards against arc damage *with J-M Ohmstone panels*

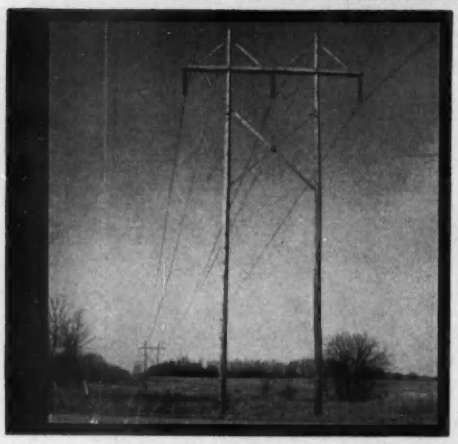
Ohio Electric Manufacturing Co. has long been known for the dependability and durability of their magnets. Exacting care is employed both in construction and selection of materials. Among these is Johns-Manville Ohmstone used as the panel board in the magnet control element. Especially designed and constructed for unusually dusty conditions, Ohmstone incorporates exceptional arc resistance and high dielectric strength.

Made of asbestos, cement and a water-repellent ingredient, Ohmstone is bonded under pressure and impregnated with a non-carbonizing insulating compound. It withstands shock and vibration . . . won't rust or rot . . . resists water, oil, gas, ordinary chemicals and sudden temperature changes.

Ohmstone can be machined and drilled to accommodate apparatus. For further information write to Johns-Manville, Box 14, New York 16, N.Y. In Canada: 565 Lakeshore Road East, Port Credit, Ontario.

Johns-Manville OHMSTONE® AN ASBESTOS PRODUCT

GALVANIZED STEEL STRAND



YOUR ASSURANCE OF HIGH QUALITY, LONG LIFE AND LOW COST

Close laboratory control over each step in manufacture has established Crapo Galvanized Steel Strand as a product of highest quality and dependability. You benefit through longer service life and lower ultimate costs.

Heavy, uniform, tightly-bonded coatings of commercially pure zinc, applied by the famous Crapo methods, withstand the punishment of construction, provide maximum resistance to corrosion and contribute to over-all economies.

For OVERHEAD GROUND WIRE . . .
CRAPO Weldless Galvanized Steel Strand

The most practical and economical strand for shielding transmission lines against lightning. Maximum strength and high fatigue endurance, inherent in Crapo Weldless Strand, provide that extra safety factor so important in overhead ground or static wire.

For GUYS and MESSENGER . . .

Crapo Galvanized Steel Strand. Made to highest standard specifications . . . a size and breaking strength to meet all practical needs.

Contact your jobber or write for descriptive folder.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

TECHNICAL LITERATURE

CONVEYORS: The guide to standards for conveyors as approved by the American Standards Association is now in "Conveyor Terms and Definitions," the industry dictionary published by Conveyor Equipment Manufacturers Assn. Designated as B 75.1-1956, UDC No. 621.867:001.4, the CEMA 64-page dictionary defines nearly 1,500 terms and contains nearly 100 drawings. The current edition is the second; the first was issued in 1952. Copies are available from Conveyor Equipment Manufacturers Assn, 1 Thomas Circle, Washington 5, D. C. at $1.00 each.

CABLE SPINNING—A 52-page booklet, entitled "Cable Spinning Data", gives a history of cable spinning, an article on placing power cable in the field; wire data, threading tensions for various wire sizes, and other related information. Also contains information on terminal installation and use of cable placing rings. Available from Cable Spinning Equipment Co, 3100 Topeka Ave, Topeka, Kan. No charge.

EEI-NEMA STANDARDS—The following publications are EEI-NEMA standards, and are available from National Electrical Manufacturers Association, 155 E. 44th Street, New York 17, N. Y.:

EEI-NEMA Standards for Street and Highway Lighting

Steel Luminaire Supports for Wood Poles, Pub No. SH 7-1956.
Film Cutouts, Pub No. SH 8-1956.
Metal Head and Reflector Interchangeability, Pub No. SH 10-1956.
Insulator Head and Reflector Interchangeability, Pub No. SH 11-1956.

NEMA Standard Publication for Enclosed Switches, Pub No. KS 1-1957, price $1.00.

NEMA Standards Publication for Panelboards, PB 1-1957, price $1.00.

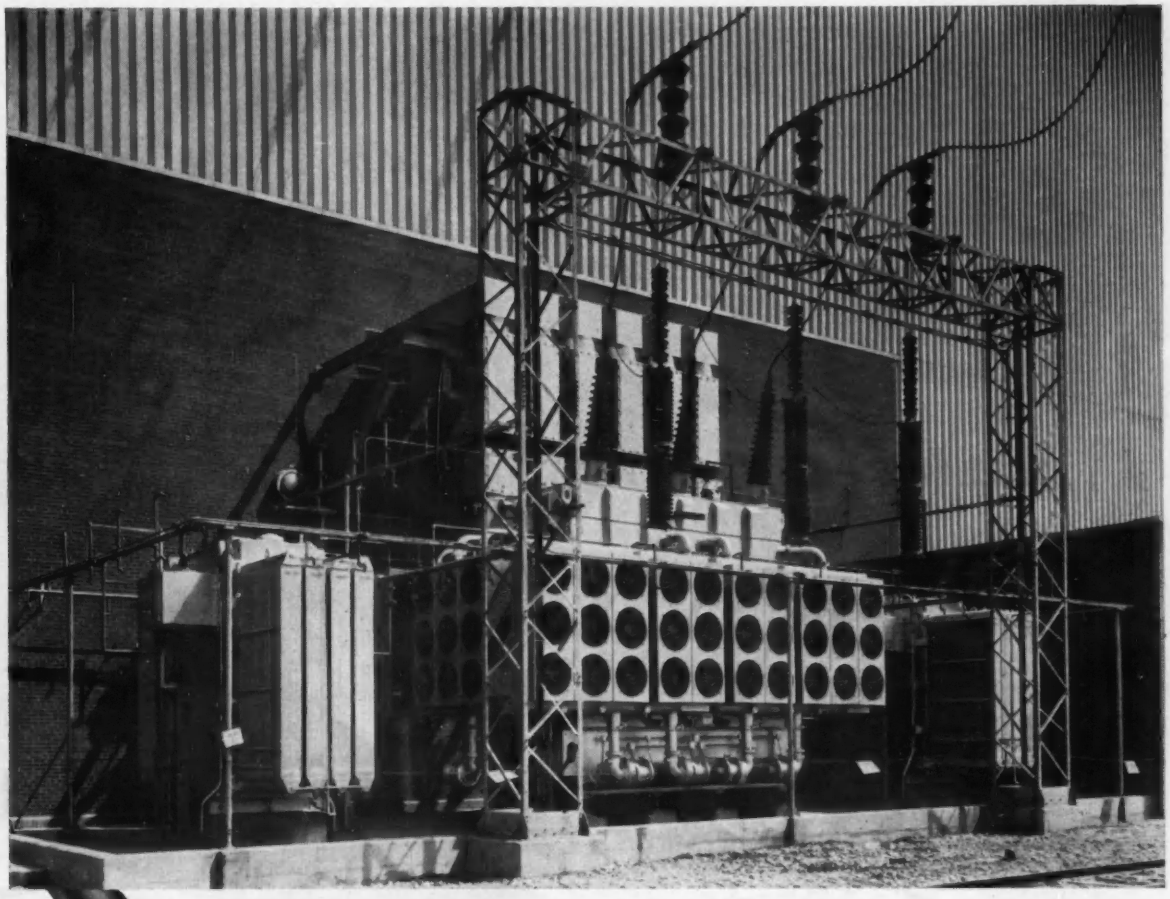
BOOKS

Electricity for Beginners

Introductory Electrical Engineering. **By George F. Corcoran and Henry R. Reed. Published by John Wiley & Sons, Inc, 440 4th Ave, New York 16, N. Y. 527 pages, illustrated. Price, $7.95.**

Circuit analysis and elementary magnetic phenomena are treated thoroughly in this introductory text to electrical engineering. It places emphasis on Kirchoff's laws, the circuital law of magnetism, Ampere's law, Faraday's law, the forces on moving charges and on current-carrying conductors, and the concepts of inductance and capacitance.

The text is said to be a complete revision of Corcoran's "Basic Electrical Engineering." It covers the material in an orderly and systematic manner, aided by many illustrations, examples, and problems. It would be useful in a basic course conducted by a utility for employees with a high school education.



Grinnell Mulsifyre provides fire protection for world's highest capacity generator transformer

In midsummer of 1956, the 315,000 KVA Westinghouse generator transformer illustrated here went "on the line" for the Detroit Edison Company at its River Rouge Power Plant. To minimize the danger of crippling fire to this—*the world's greatest capacity generator transformer*—Detroit Edison installed a Grinnell Mulsifyre System.

Grinnell Mulsifyre attacks oil fires in these different ways:

- By the formation of a fire-extinguishing blanket of emulsion on the surface of the oil.
- By introducing water vapor molecules between the oil vapor and oxygen molecules, to make the resulting mixture unburnable through "vapor dilution".
- By cooling oil at its surface, thus slowing down production of burnable vapor.
- By using up heat through flash evaporation of water, to keep oil vapor below the ignition point.

Case histories exist where fast-acting Mulsifyre systems have extinguished transformer oil fires in seconds. For details, write Grinnell Company, Inc., 252 West Exchange St., Providence, Rhode Island.

GRINNELL

WHENEVER FIRE PROTECTION IS INVOLVED

GRINNELL COMPANY, INC., PROVIDENCE, RHODE ISLAND • Branch Offices in Principal Cities

take a long look at...

meter economics

You can effect prompt and progressive savings by standardizing now on the *meter of the future* — the Westinghouse Lifetime 30-ampere, single-phase meter. With full 200-ampere extended range, it will measure all present and future single-phase residential loads that can be provided on single-phase service, and *it is guaranteed for 30 years.*

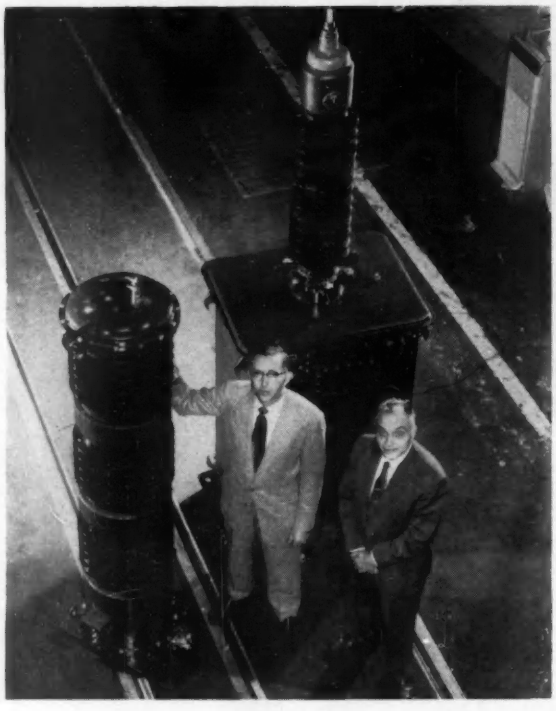
This year, 57% of the single-phase watthour meters purchased and installed by the Electric Utility Industry represented change-outs due to obsolescence in the face of growing load. The other 43% went on new homes with high initial loads and rapid growth potential.

This new 30-ampere Westinghouse meter certainly is the meter for this year — and '66 — and '76 — and even '86. First, consider the value of simplified inventory — if you standardized! Then take notice that there is *not one cent more investment,* initially, *than for modern 15-ampere ratings.* There's no mathematical trick. Call your Westinghouse sales office, or your Westinghouse meter specialist . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-40493

YOU CAN BE **SURE**...IF IT'S

Westinghouse



GE's "Cascade" 45% Cheaper

General Electric Co Engineers C. H. Tuttle, left, and G. Camilli compare compactness of the company's new Cascade potential transformer with a conventional unit. Connected-in-series winding of the Cascade makes for a lighter transformer at a 45% lower price than conventional transformers, GE says.

Designed for line-to-ground connections on 115 through 230 kv, the unit carries an ASA-rated 0.3 accuracy at standard burdens. Instead of complete insulation for full line-to-ground voltage, the Cascade uses three or more stages, each designed for a proportionate share of total system voltage, GE said. Because only part of this voltage is applied to each section, the insulation material requirements are reported to be reduced.

Individual core and coils are housed in steel sections. Oil is common throughout the transformer interior. Expansion space is provided at the top. An equal voltage division is forced by inserting porcelain insulators between sections and interconnecting auxiliary windings.

GE engineers say the new unit has a 4-kva minimum thermal capacity and withstands full line-to-line voltage under emergency conditions. The unit meets ASA standard impulse strength levels.

S. M. Smith Co Gets Order to Rebuild 3 Water Wheels

A turbine-rebuilding order, valued at $250,000, was recently awarded to S. Morgan Smith Co of York, Pa., by the city of Seattle, Wash.

The contract calls for increasing the power output of three 37,000-hp vertical Smith-Francis turbines to 45,000 hp each under a 325-ft head at 257 rpm. The turbines are located at the Gorge Plant of the city of Seattle. Actually, this will be their second modification. Originally installed in 1922 and 1923 for 27,500 hp under a rated head of 275 ft, their design allowed for an increase to 37,000 hp under a future rated head of 325 ft. Because the ultimate maximum head was expected to rise as high as 375 ft, the generators were purchased for a maximum potential output in excess of 37,000 hp. Recent power shortages in the Washington area have made it necessary to increase the plant output. The dam's height is already being raised.

Model tests at the Smith Co's laboratory proved the feasibility of increasing the existing turbine output by more than 20%. Reportedly, full generator capacity may be obtained with the new rated head, with only limited modifications to the original design. Delivery is scheduled for the first half of 1958.

A-C Sales Hit New High; Net Income Drops Off

A new record for sales was announced by Allis-Chalmers in a report on 1956 operations. Sales hit $547,439,265, or more than $12 million above 1955.

Net income amounted to $20,355,045 last year, equal to $2.42 per share of common stock. In 1955, profits were $24,805,326, or $3.03 a share.

Dividends paid on common stock for 1956 totaled $16,044,658. On outstanding preferred $635,857 was paid.

Pres R. S. Stevenson pointed out in a letter to stockholders that the backlog of unfilled orders at the close of 1956 was $226 million, an increase of more than $100 million in two years. Outlook for utility expansion continues bright, he assured the stockholders.

Dual-Voltage Transformers Speed Change-Over

A line of dual-voltage distribution transformers has been announced by RT&E Corp, Waukesha, Wis. The line utilizes an externally operated voltage change-over switch which reduces labor time, down time, and transformer costs when a system voltage increase is planned, the company says.

A 90% rotation of the switch accomplishes the change-over to higher voltages, the company claims. Transformers with the device are available from 10 through 167 kva with primary combinations of 2,400 x 4,800, 2,400 x 7,200, 4,800 x 14,400, and 7,200 x 14,400 v. They have standard secondary voltages.

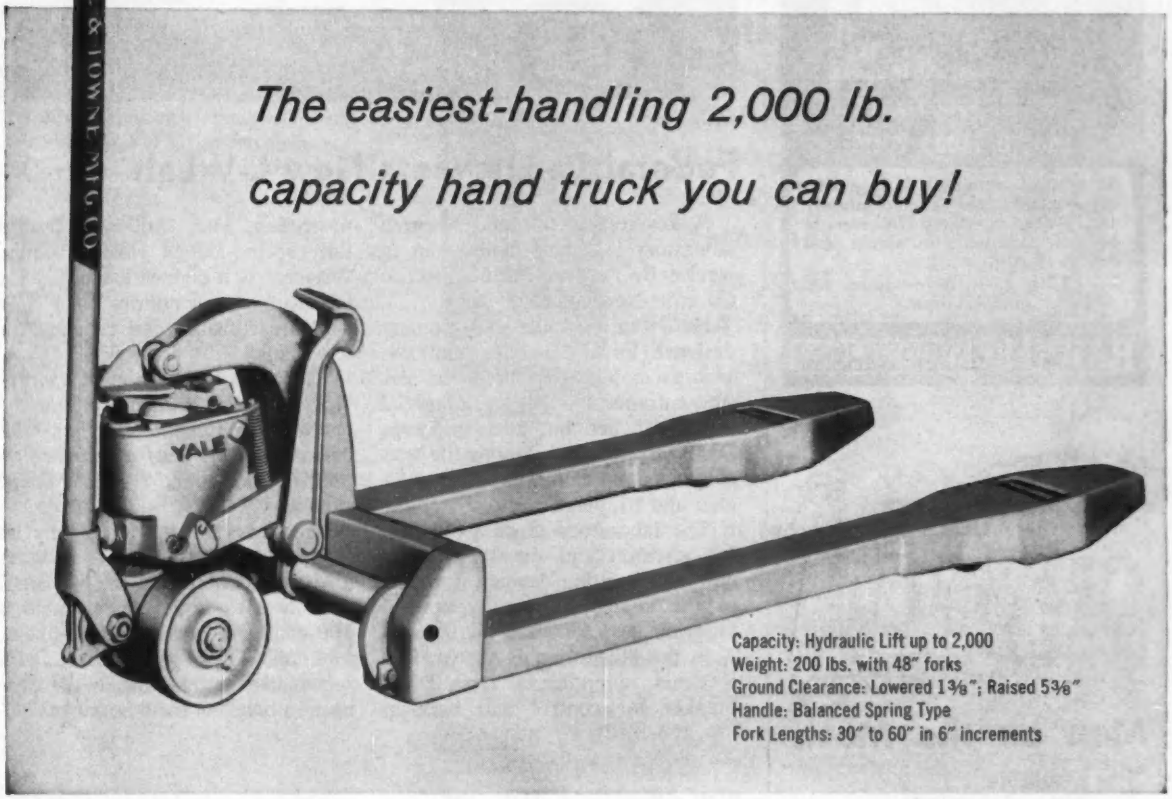
(More M&M on page 152)

YALE

LIGHTWEIGHT

MODEL A HYDRAULIC HAND LIFT PALLET TRUCK

The easiest-handling 2,000 lb. capacity hand truck you can buy!



Capacity: Hydraulic Lift up to 2,000
Weight: 200 lbs. with 48" forks
Ground Clearance: Lowered 1⅜"; Raised 5⅜"
Handle: Balanced Spring Type
Fork Lengths: 30" to 60" in 6" increments

Easy handling Yale Model A Hand Pallet Trucks are preferred by workers because there's less deadweight to pull or push...maneuvering in crammed quarters is easier. Furthermore, with easy foot pedal strokes the operator can lift a capacity load of 2,000 lbs. a full 4 inches...and clear the load over 5" from the ground. This extra underclearance makes difficult rampwork easy and safe. And, dual-articulated steering wheels give greater ease of steering, load stability and smoother handling over rough surfaces...while smooth-acting lowering mechanism protects loads from shocks.

In your plant, warehouse or shipping area, new Yale Lightweight Hand Trucks eliminate time-consuming piece-by-piece handling...keep materials flowing smoothly to avoid production slowdowns...help workers move more tonnage per shift...reduce operator fatigue. These benefits apply to your operation whether you use one Yale Hand Truck or a number of them as part of an integrated handling system.

Yale Model A Hand Trucks are now in full production and ready for fast delivery. For full facts, write The Yale & Towne Mfg. Co., Phila. 15, Pa., Dept. 1273.

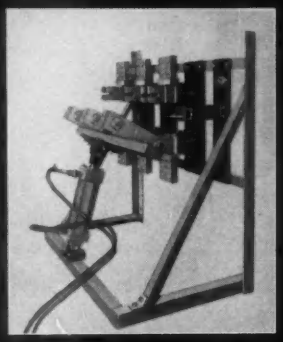
YALE* **INDUSTRIAL LIFT TRUCKS AND HOISTS**

*REG. U. S. PAT. OFF.

Gasoline, Electric & LP-Gas Industrial Lift Trucks • Worksavers • Warehousers • Hand Trucks • Hand and Electric Hoists

Profit Gains

New AIR OPERATED
INDOOR DISCONNECT SWITCH
by BARKELEW

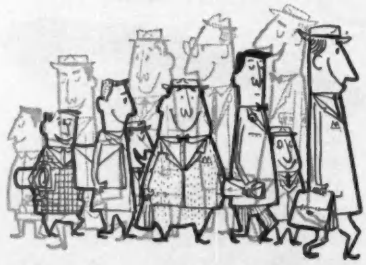


200 TO 12000 AMPS
250 TO 15000 VOLTS

A new air-operated indoor disconnect that can be conveniently and safely operated by remote control. Available in single and double throw.

Write Dept. B for more information.

BARKELEW ELECTRIC MFG. CO. MIDDLETOWN, OHIO



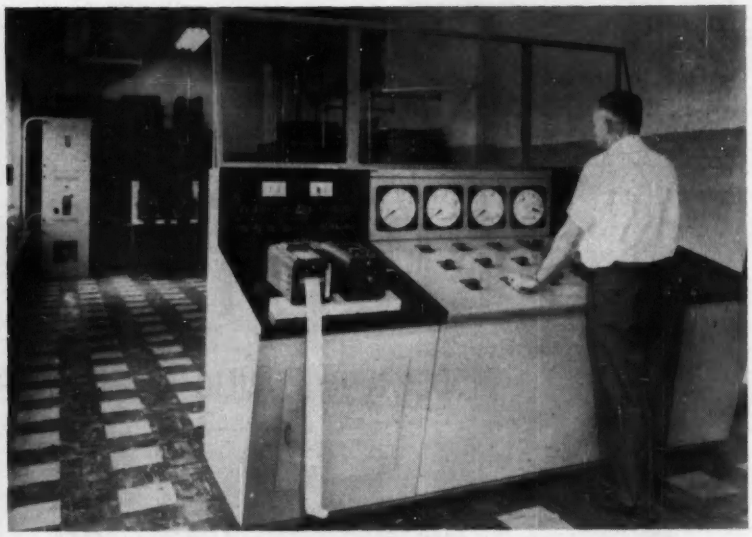
Men on the Move

Now available
in a *new edition*...
with *new figures.*

This popular booklet points up the important sales problem of personnel turnover in industry. Out of every 1,000 key men (over a 12-month period) 343 new faces appear . . . 65 change titles . . . 157 shift . . . and 435 stay put. These figures are based on average mailing address changes on a list of over a million paid subscribers to McGraw-Hill magazines.

Write us for a free copy

Company Promotion Department
McGraw-Hill Publishing Co., Inc.
330 West 42nd Street,
New York 36, New York



Federal Pacific Gets New L-V Lab

A low-voltage test and research laboratory is a new facility put in service by Federal Pacific Electric Co at its Newark, N. J. plant.

Here tests are made on equipment designed for circuits up to 600 v, such as molded case breakers, service entrance equipment, industrial safety switches, bus duct, and type DMB air breakers. Among the tests conducted are calibration, life, overload and tripping.

The laboratory is designed also for research and development of new and existing devices, for part of the company's quality control program, and for local UL testing.

In the illustration is shown, left, a panel mounting a type DMB breaker for control and back-up protection, and 1200-amp heavy-duty spring-loaded closing switch. Adjacent is a connection board for transformer secondaries. At right wall are resistors and reactors for test loads.

The console is designed to provide control of manual or automatic test programming. Results are indicated on meters and/or recorded on oscillographs and high speed camera.

This laboratory is served by an outdoor substation. Latter includes a disconnect switch; a 600-amp, 34.5-kv oil circuit breaker; and a 500-kva bank of three single-phase, 13.2/26.4-kv transformers with secondaries terminating at the connection board in the laboratory.

Polio Program Wins Kudos for Penn Transformer

A "certificate of appreciation" was awarded Pennsylvania Transformer Division of McGraw-Edison Co for a role played in stimulating polio vaccination programs in industry. A representative of the National Foundation for Infantile Paralysis made the presentation at firm's 28th anniversary celebration.

The recognition was accepted by W. E. Kerr, president of the subsidiary and a vice president of the parent company. The division's 1956 offer of free polio vaccine for employees generated nationwide interest. Since the company's offer to assist others in setting up vaccination programs, many manufacturers have followed suit.

S & C Has Family Day

S & C Electric Co, Chicago recently held a "Family Day" at its Ridge Avenue Plant. About 2,500 people—employees, their families and friends—made a tour of the plant, were entertained and served refreshments. The plant was kept in operation as the tours were conducted.

Profit Gains

. . . brighten Westinghouse outlook; equipment accomplishments cited in year-end report

Although gains lagged behind improved production, Westinghouse Electric Corp's profit performance "showed an encouragingly steady upward trend in the second, third and fourth quarters." This summary of Pres Gwilyam A. Price was in a report to stockholders.

"After a first quarter loss of $1.14 (per share) caused by strikes, net income in the second quarter was 38¢, in the third quarter 59¢ and 98¢ in the fourth quarter before the effect of LIFO on earnings for the quarter," he said. LIFO is a "last-in, first-out" method of inventory evaluation.

Net sales billed for 1956 amounted to $1,525,375,000, confirming previous figures published (EW, Feb. 11, p 116). This is a gain of 6% over 1955. Net income for the period was $15,537,000 before LIFO. Net after applying LIFO was $3,492,000, or 10¢ a share.

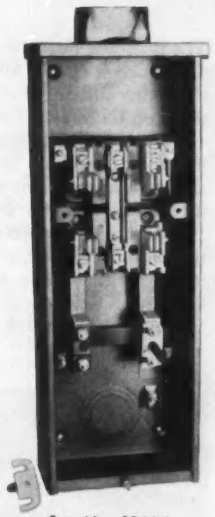
Price described "outstanding" achievements for the year. He cited the 16 inner-cooled turbine generators, with aggregate capacity of over 2½-million kw, completed in 1956; Sharon, Pa., "indoor proving ground" for testing of transformers weighing more than 400 tons and rated at 500,000-plus kva; and completion of development on a 5,000-psi turbine for a 325,000-kw unit.

Heat-Pump Line Slated

York-Shipley, Inc, York, Pa., plans to market a heat-pump line designed to eliminate installation problems, the company announced recently. Research and development has brought the units' integration with the firm's line of air-cooled condensing units for remote installations. Heat pumps will be connected to the evaporator section through pre-charged refrigerent lines, said Pres S. H. Shipley. The line is slated for home and commercial applications.

ANCHOR

HIGH CAPACITY
200 AMPERE SOCKETS



Cat. No. 2044M
Both Covers Removed

WITH OR
WITHOUT
FULL
CAPACITY
AUTOMATIC
OR
MANUAL
BY-PASS
FOR 4, 5, 6 OR 7
TERMINAL
METERS

Cat. No. 2044M

Patented Anchor design of heavy-duty jaws formed from one piece of 3/16" copper, silver plated after fabrication, control temperature rise to 30°C on 200 ampere load.

The terminals are for 4/0 wire and have maximum width screws with specially cupped ends which hold copper or aluminum cables without damage to the strands.

Also can be furnished with similar screws equipped with pressure plates.

Boxes can be of galvannealed steel with baked grey finish, or sheet aluminum, natural finish.

Flush or surface mounting.

Hubs: through 2½" for 4, 5 or 6 terminal, and through 3" for 7 terminal sockets.

Ample knockouts to match hub sizes.

Send for Complete Information

ANCHOR MANUFACTURING CO.
MANCHESTER, NEW HAMPSHIRE

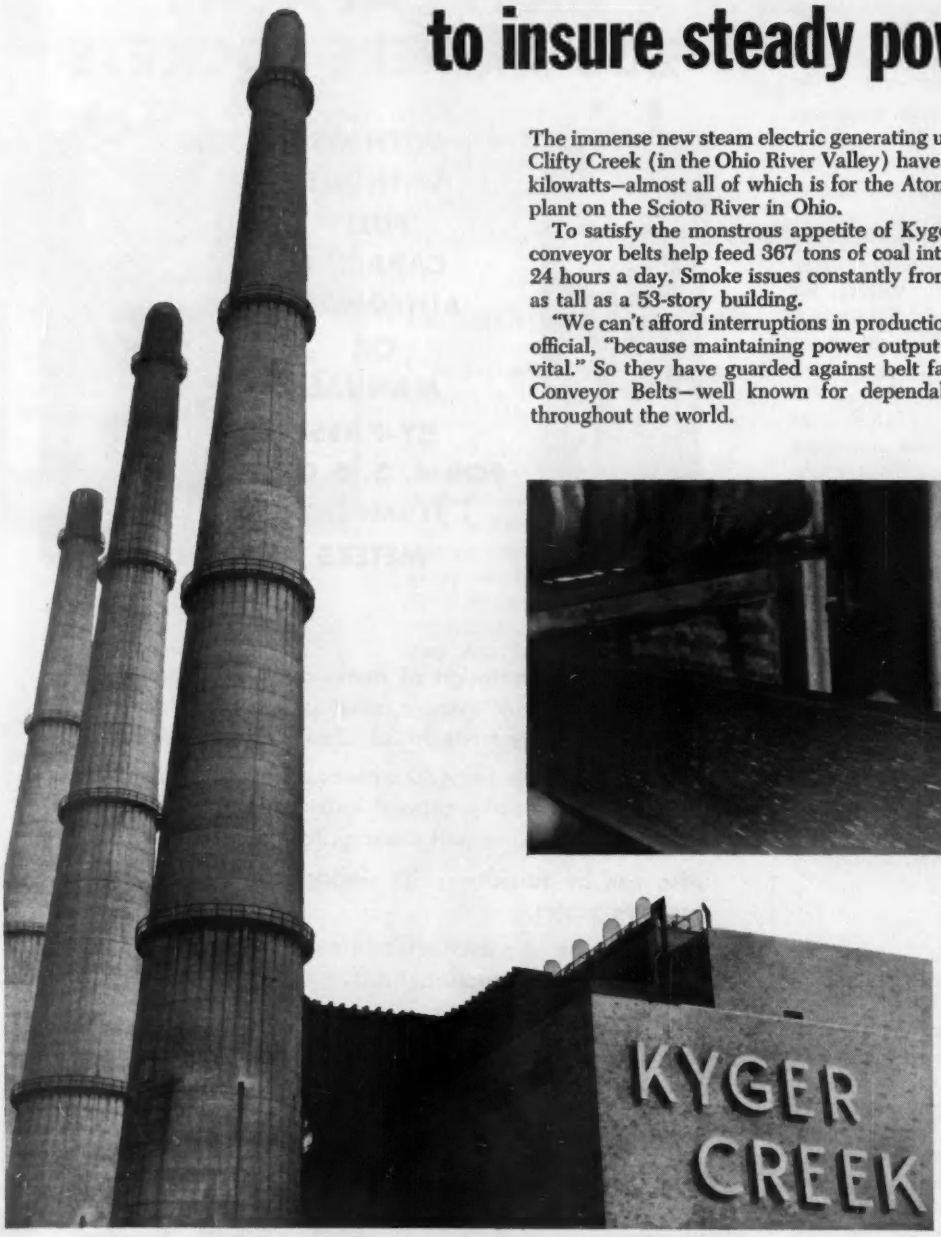
US RUBBER CONVEYOR BELTING

Delivering 367 Tons of Coal per Hour... to insure steady power flow

The immense new steam electric generating units at Kyger Creek and Clifty Creek (in the Ohio River Valley) have a capacity of 2,365,000 kilowatts—almost all of which is for the Atomic Energy Commission plant on the Scioto River in Ohio.

To satisfy the monstrous appetite of Kyger Creek, U. S. Rubber conveyor belts help feed 367 tons of coal into its boilers every hour, 24 hours a day. Smoke issues constantly from the giant stacks, each as tall as a 53-story building.

"We can't afford interruptions in production," says a ranking plant official, "because maintaining power output for the atomic plant is vital." So they have guarded against belt failure by selecting U. S. Conveyor Belts—well known for dependability by power plants throughout the world.



(above)
The Number One conveyor belt emerging from the unloader hopper at Kyger Creek. This 48" wide U. S. Matchless® belt provides excellent troughability, extreme rip resistance, fine training and long life. This excellent conveyor system and belting mean considerable savings in manpower to move the coal supply.

SALES ASSIGNMENTS

US RUBBER EXPANSION JOINTS

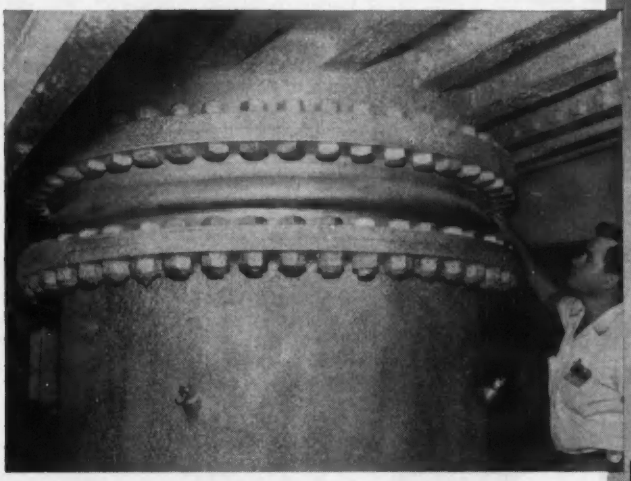
84,000 Gallons of Water per Minute for atomic energy plants

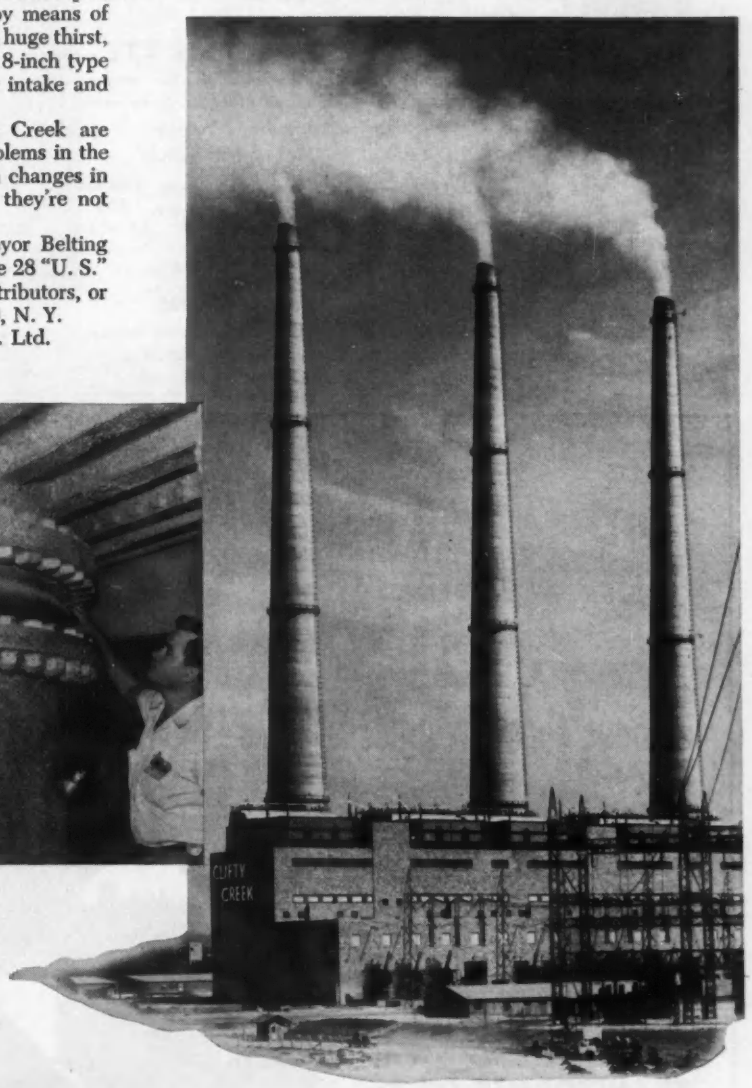
The Clifty Creek steam electric plant brings in and expels river water at 84,000 gallons per minute, by means of circulating water pumps. To help quench this huge thirst, U. S. Rubber Expansion Joints (from small 8-inch type to big 66-inch type) are used on the water intake and discharge pipes.

These U. S. Expansion Joints at Clifty Creek are handling the contraction and expansion problems in the pipe lines excellently. They can take sudden changes in temperature, they can handle shocks, and they're not bothered by corrosion.

A complete line of U. S. Rubber Conveyor Belting and Expansion Joints is available at any of the 28 "U. S." District Sales Offices, at selected "U. S." distributors, or write us at Rockefeller Center, New York 20, N. Y.

In Canada, contact Dominion Rubber Co. Ltd.



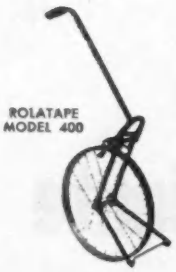


Above is one of the many 66-inch U. S. Expansion Joints on a water intake line at the Clifty Creek Plant. None of these joints, no matter what the size, has ever given Clifty Creek any problem. They are performing excellently, on a tough job.

Mechanical Goods Division

US RUBBER **United States Rubber**

Wood pole structures for transmission lines are STRONGER, BETTER,


ROLATAPE MODEL 400

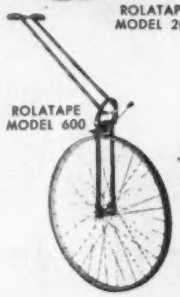
ROLATAPE is the Fast, Efficient, Economical, Modern way to measure. Model #400 is widely used by Road Construction Companies, Telephone Companies, Utilities, Sewage Departments and many other industries where measurements are important.

MEASURING time is cut to a fraction with Rolatape. Model #200 is extremely popular with Real Estate Men, Appraisers, Traffic Officers and many others who demand fast, accurate, measurements.

ROLATAPE MODEL 200

WHEELS on all Rolatapes are precision calibrated, and can be depended upon for long-life service. Model #600 is a special model for long-distance, acreage measuring and for use over rougher terrain.

FOR FAST, ACCURATE measuring—Rolatape Measuring Wheels are the answer. Models #400 and 600 measure distances up to nearly nineteen miles.


ROLATAPE MODEL 600

MEASURING is simple, time-saving, and efficient when you use a Rolatape. FOR COMPLETE DETAILED ROLATAPE INFORMATION, SEE YOUR DEALER, DISTRIBUTOR, OR WRITE TO:

ROLATAPE, INC.

Factory: 1741 Fourteenth Street, Santa Monica, California

DID MACY'S TELL GIMBELS

about those wonderful **MARCUS** transformers

We don't know . . . but both of these nationally famous department stores use Marcus Transformers for power and lighting distribution.

Marcus "Mark of Quality" transformers GUARANTEE trouble-free service and safe, dependable operation. For bigger profits and greater customer satisfaction, use MARCUS for your next installation.

MARCUS TRANSFORMER CO., Inc.
RAHWAY, NEW JERSEY

Representatives in Principal Cities

MTC "Mark of Quality"

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

SALES ASSIGNMENTS

COMPANY STAFFS

Bailey Meter Co has advanced Robert S. Darke from sales engineer to sales manager of the new Metrotype Division.

Chase Brass & Copper Co, a subsidiary of Kennecott Copper Corp, has announced the following promotions which take effect May 1: Leland S. Hanson, former eastern regional sales manager, will be executive sales director; Charles A. Festge, will rise from district manager at Milwaukee to succeed Hanson; and Edward J. Finn, of the Waterbury general sales department, will replace Festge.

Federal Pacific Electric Co's John W. Muse has been appointed New England district sales manager. He is former New England promotion manager specializing in distributor sales activities.

Four Wheel Drive Auto Co has named Arthur J. Sturwold district sales manager in Illinois, Michigan, northern Indiana, and eastern Missouri.

General Electric Co's silicone products department has designated K. Jerry Morray as manager of the Cleveland sales district. Until this assignment he was a sales and product planning specialist in the chemical materials department . . . Gene H. Whitfield has been named a Carboloy carbide cutting tool sales representative in GE's Cleveland east central district. His territory includes Evendale, Ohio, and parts of several states south of Cincinnati.

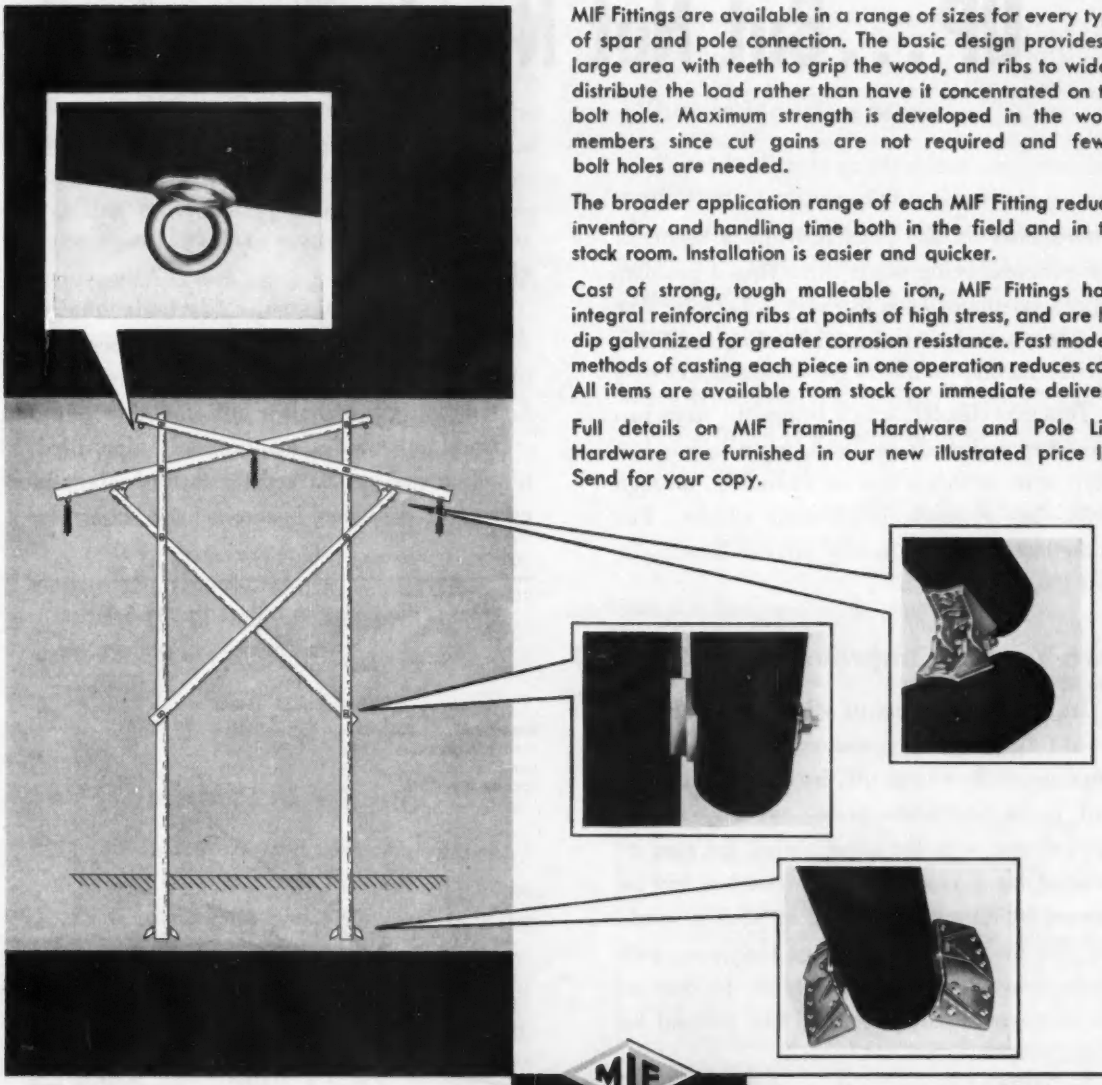
Gould-National Batteries, Inc, has named George R. Powers, Jr, as St. Louis regional manager of the Industrial Division. He will serve in the eight state area of Nebraska, Kansas, Oklahoma, Missouri, Arkansas, southern Illinois, southern Indiana, and western Kentucky.

Kuhlman Electric Co's Transformer Division has as its new northern regional sales manager Justin A. Zager, formerly a sales engineer with Buffalo Electric Co. The northern area encompasses 26 northeastern and northcentral states including Virginia, Kentucky, Missouri, Kansas, Nebraska, and North and South Dakota.

Nordberg Manufacturing Co has named G. B. Wright as district manager of the Great Lakes territory to succeed Louis Rove who has retired. Wright will follow both stationary and marine engine sales in Michigan, Indiana, Ohio, Kentucky, and western Pennsylvania and marine engine sales in the Chicago area and on the Ohio River from Evansville to Pittsburgh. . . . Newly named sales engineer for the company is Stephen H. Reed, who will make his headquarters at Houston, Tex.

Western Precipitation Corp has named Robert F. Stewart sales manager of its Precipitator Sales Division, Los Angeles.

Wood pole structures for transmission lines are STRONGER, BETTER, LOWER IN COST, when connected with MALLEABLE IRON framing hardware



MIF Fittings are available in a range of sizes for every type of spar and pole connection. The basic design provides a large area with teeth to grip the wood, and ribs to widely distribute the load rather than have it concentrated on the bolt hole. Maximum strength is developed in the wood members since cut gains are not required and fewer bolt holes are needed.

The broader application range of each MIF Fitting reduces inventory and handling time both in the field and in the stock room. Installation is easier and quicker.

Cast of strong, tough malleable iron, MIF Fittings have integral reinforcing ribs at points of high stress, and are hot dip galvanized for greater corrosion resistance. Fast modern methods of casting each piece in one operation reduces cost. All items are available from stock for immediate delivery.

Full details on MIF Framing Hardware and Pole Line Hardware are furnished in our new illustrated price list. Send for your copy.

SINCE 1854
POLE HARDWARE DIVISION

MALLEABLE IRON FITTINGS CO.
BRANFORD, CONNECTICUT

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Hugo Sales Co., Minneapolis, Minn. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. • Lee-Smith Co., Miami, Fla. • Line & Cable Accessories, Ltd., Toronto, Ontario, Canada • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Slaybaugh-Thompson Co., Denver, Colo. • Robert P. Smith & Co., Jacksonville, Fla. • E. A. Thornwell, Inc., Atlanta, Ga. • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Cal. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas, Houston, Tex.; Pine Bluff, Ark. • O. C. Witte Co., Detroit, Mich.

A Progress Report on Faculty Salaries:

UP... But Not Nearly Enough

THE CHART on this page provides a report of the progress being made in solving a problem of crucial importance to every American. The problem is that of seeing that college and university faculty members get decent salaries.

This new chapter, which brings the story forward two years—from 1954, when it was last dealt with in this series of editorials, through 1956—has a decidedly cheering element. For in the last two years faculty salaries have made real headway.

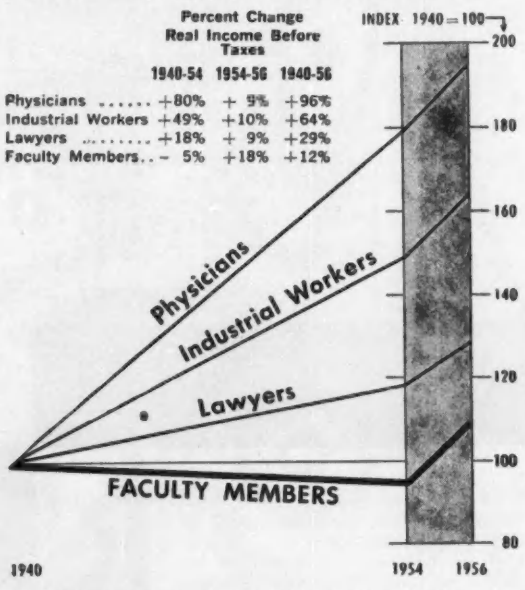
Two Years of Improvement

In 1954, in terms of what their salaries would buy, faculty members as a whole were actually worse off, by 5%, than they had been fourteen years earlier. As the chart shows, over the same period the real income of the average industrial worker had increased by almost half. And, in what it would buy, the income of the average physician, with professional training comparable to that of the average faculty member, had jumped by 80%.

In 1956, however, the average faculty salary would buy about 12% more of goods and services than it would in 1940. Relative to where they were two years before, faculty salaries showed a larger gain over the two years than those of any of the other groups whose salary progress is charted.

This movement of faculty salaries in the right direction has many contributing causes. The biggest single boost was given by the great Ford Foundation gift of half a billion dollars to our colleges, universities, and hospitals, almost half of which was ear-marked for faculty salary increases. Gifts from business firms have also

What is Happening to College Faculty Salaries



DATA: Council for Financial Aid to Education, U. S. Dept. of Commerce, U. S. Dept. of Labor, National Association of Education Research Dept., McGraw-Hill Dept. of Economics.

MEETINGS CALENDAR

helped a lot. And so, in many cases, have stepped-up money-raising campaigns by alumni groups and cooperative regional and state groups of colleges.

Still a Long Way to Go

However, faculty salaries started their ascent from such a dismal depth that they still have a long, long way to go up before there is room for the comfortable conviction that they are fair, or even safe, from the standpoint of protecting the nation's vital interests. It still remains possible to find many shocking companion pieces for the following incident recently reported to a McGraw-Hill executive group, working on problems of financial aid to higher education, by the president of an illustrious small liberal arts college.

"The recruiting officer of one of our large industrial companies came to our campus a few weeks ago," the college president said, "and offered five of our seniors higher salaries to start working for that company when they are graduated next June than the salary received by any member of our faculty. And the seniors, of course, promptly went to their professors to seek advice on whether or not they should accept. It doesn't take much imagination to see what this sort of thing does to the morale of a faculty."

Senior Teachers Fare Badly

One of the more devastating things it does, of course, is to make the more experienced college and university faculty members receptive to the idea of going to greener pastures, currency-wise, in business and industry.

For these senior faculty members the financial pounding in the past 16 years has been even worse than the chart indicates. While the average real salary gain reported by the chart has been 12%, the average salary of a full professor still buys less than it did in 1940. This is because most of the salary increases have gone to beginning instructors, for whose services industry has been providing the sort of competition reported by the liberal arts college president.

And it creates this financial lackluster of posts as senior college faculty members right at the time their services are needed more than ever to handle the oncoming flood of college and university students. Between now and 1970 college and university enrollment is expected to double.

What is Needed Now

What is clearly needed is a continuation and intensification of the drive to increase their salaries to a point where college and university faculty members will be sharing somewhere near fully in the general prosperity of the nation. It could be counted good progress in this direction if over the next two years faculty salaries on the average were to go up another 12%, with most of the increase concentrated in the senior faculty ranks. And this can be made possible only through more outside contributions.

There is reason to be encouraged by the progress that has been made over the past two years in bailing college and university faculty members out of the terrible financial hole into which they were allowed to slide. But there is the most urgent occasion to keep at it and harder.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

Utilities everywhere

MEETINGS CALENDAR

MARCH

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

National Association of Corrosion Engineers—Annual Convention, Kiel Auditorium, St. Louis, Mo., Mar. 11-15.

National Electrical Manufacturers Association—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

Electric Companies Public Information Program—Steering Committee, New York, Mar. 14.

Canadian Electrical Association—Western Zone Meetings, Hotel Vancouver, Vancouver, B. C., Mar. 18-20.

Institute of Radio Engineers—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

• **American Society of Mechanical Engineers**—Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, sponsored jointly with the American Institute of Electrical Engineers, Penn Sheraton Hotel, Pittsburgh, Pa., Pittsburgh, Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Electric Meter Institute—Eighth Annual Session, University of Denver, Denver, Colo., Mar. 25-29.

American Power Congress—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

Oklahoma Utilities Association—Annual Convention, Hotel Tulsa, Tulsa, Oklahoma, Mar. 28-29.

Illuminating Engineering Society—Pacific Northwest Regional Conference, Empress Hotel, Victoria, B. C., Canada, Mar. 28-30.

APRIL

Edison Electric Institute—Industrial Power and Heating Committee, Edgewater Beach Hotel, Chicago, Ill., April 1; Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; Accounting Division Advisory and Executive Committee, Madison Suite, Sheraton Park Hotel, Wash., D. C., April 8; National Accounting Conference of Electric & Gas Utility Accountants, held jointly with AGA, Washington, D. C., April 8-10; Industrial Relations Committee, jointly with Personnel Sections of Indiana Electric Assn. and Ohio Electric Utility Institute, and Personnel Practices Committee of Pennsylvania Electric Assn., Netherland Plaza Hotel, Cincinnati, Ohio, April 18-19; Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26; Purchasing and Stores Committee Executive Committee and 10th Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., April 28-May 1, Insurance Committee, Williamsburg Inn, Williamsburg, Va., Apr. 29-30; Accident Prevention Committee, Algiers Hotel, Miami Beach, Fla., April 29-May 1.

Southeastern Electric Exchange—24th Annual Conference, Boca-Raton Hotel and Club, Boca Raton, Fla., April 1-3.

National Industrial Conference Board—8th Atomic Energy Courses for Management, Rye, N. Y., April 1-6.

Indiana Electric Association—17th Annual Young Men's Utility Conference, Terre Haute House, Terre Haute, Ind., April 3-4.

Northwest Public Power Association—Annual Membership Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 3-5; Engineering and Operations Section, Tacoma Utility Center and Winthrop Hotel, Tacoma, Wash., April 23-24.

American Institute of Electrical Engineers—Southern District Meeting, Heidelberg Hotel, Jackson, Miss., April 3-5; Great Lakes District Meeting, Hotel Fort Des Moines, Des Moines, Iowa, April 15-17; Third Biennial Conference on Electric Heating, sponsored jointly by AIEE and the Toledo section of AIEE, Commodore Perry Hotel, Toledo, Ohio, April 23-24.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

American Society of Mechanical Engineers—Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., April 8-10.

Northeast Missouri Electric Power Cooperative—Eighth Annual REA Electric Generating Plant Operation and Maintenance Conference, Phillips Hotel, Kansas City, Mo., April 8-11.

National Electrical Industries Show—Fourth National Electrical Industries Show, 71st Regiment Armory, Park Ave. and 34th St., New York City, April 8-11.

• **Public Utilities Association of the Virginias**—Rural Committee, Jackson's Mill, W. Va., April 9; Executive Committee, Richmond, Va., April 12.

Institute of Radio Engineers—First Annual Conference on Electronics in Industry, Illinois Institute of Technology, Chicago, Ill., April 9-10.

American Welding Society—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Electrical Engineers (ASEE) Exhibition, Ltd—Sixth Electrical Engineers Exhibition, Earls Court, London, England, April 9-13.

Pennsylvania Electrical Association—Meter Committee, Garden City, Long Island, New York, April 11-12.

Maryland Utilities Association—Annual Spring Business Conference, Lord Baltimore Hotel, April 12.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, A&M College of Texas, College Station, Tex., April 15-17.

Rocky Mountain Electrical League—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 21-24.

• **Lead Industries Association**—Annual Meeting sponsored jointly with the American Zinc Institute, Drake Hotel, Chicago, Ill., April 24-25.

Association of Edison Illuminating Companies and Edison Electric Institute—Meter and Service Committee, Soreno Hotel, St. Petersburg, Fla., April 24-26.

Northwest Electric Light & Power Association—Engineering and Operating Section, Sun Valley, Idaho, April 24-26.

Institute of Radio Engineers—Eleventh Annual Technical Conference on Television, Cincinnati Engineering Society Bldg., Cincinnati, Ohio, April 26-27.

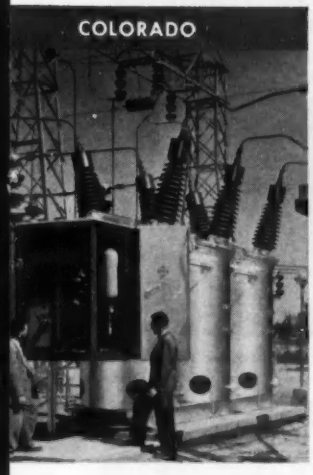
MAY

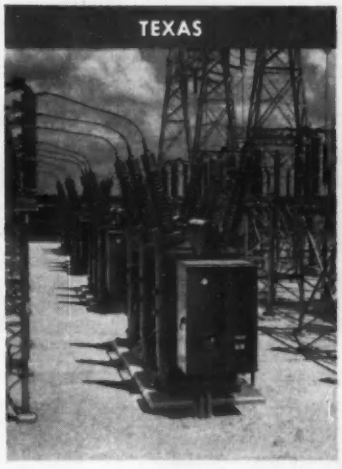
Edison Electric Institute—Transmission and Distribution Committee, Muehlebach Hotel, Kansas City, Mo., May 2-3; Prime Movers Committee, Tides Hotel, St. Petersburg, Fla., May 6-8; Industrial Relations Committee, EEI Headquarters, New York City, May 16; Electrical System and Equipment Committee, Statler Hotel, Buffalo, N. Y., May 20-21; Accounting Division Time and Place Committee jointly with AGA, AGA Headquarters, New York City, May 22; Financing and Investor Relations Committee, Edgewater Beach Hotel, Chicago, Ill., May 31-June 1.

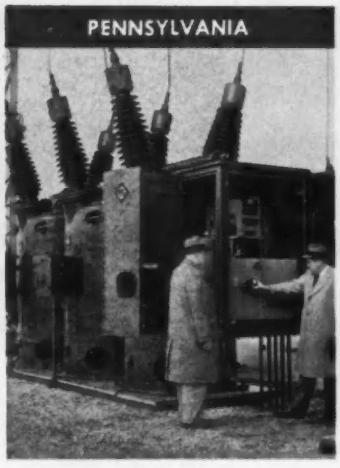
Pacific Coast Electrical Association—Annual Convention, Fairmont Hotel, San Francisco, Calif., May 15-17.

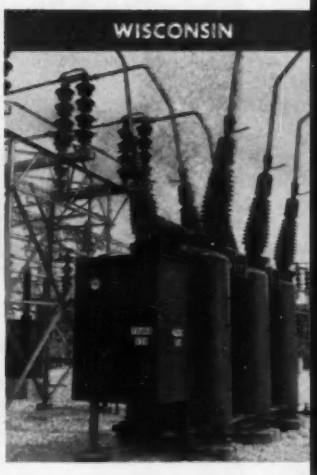
• Additions this week.

Utilities everywhere like Pneu-Draulic operators

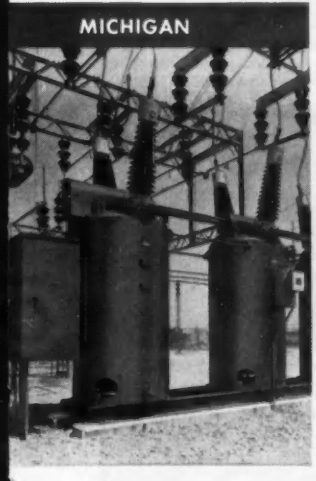


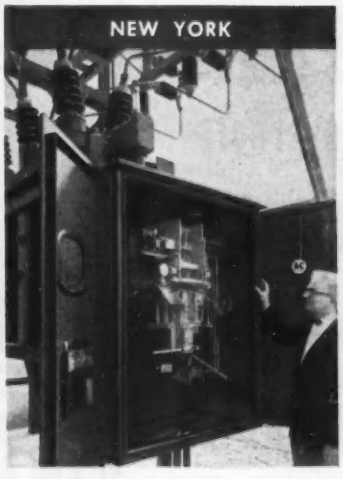


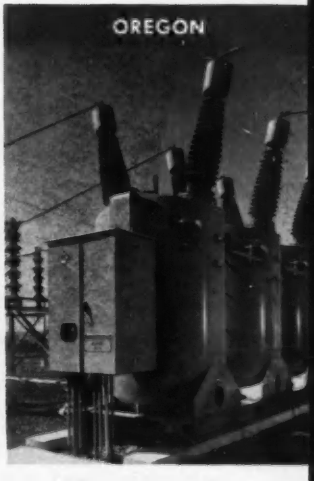




for their simplicity, reliability







***Pneu-Draulic* operators offer Utilities many advantages:**

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- Safe emergency closing — Breaker can be closed *safely* at full rated speed onto energized line even when no control power is available.
- Mechanically trip-free operation — Fully mechanically trip-free for complete system protection.
- Available on a wide range of breaker ratings — Breakers rated 500 mva and larger use the *Pneu-Draulic* operator as standard equipment.

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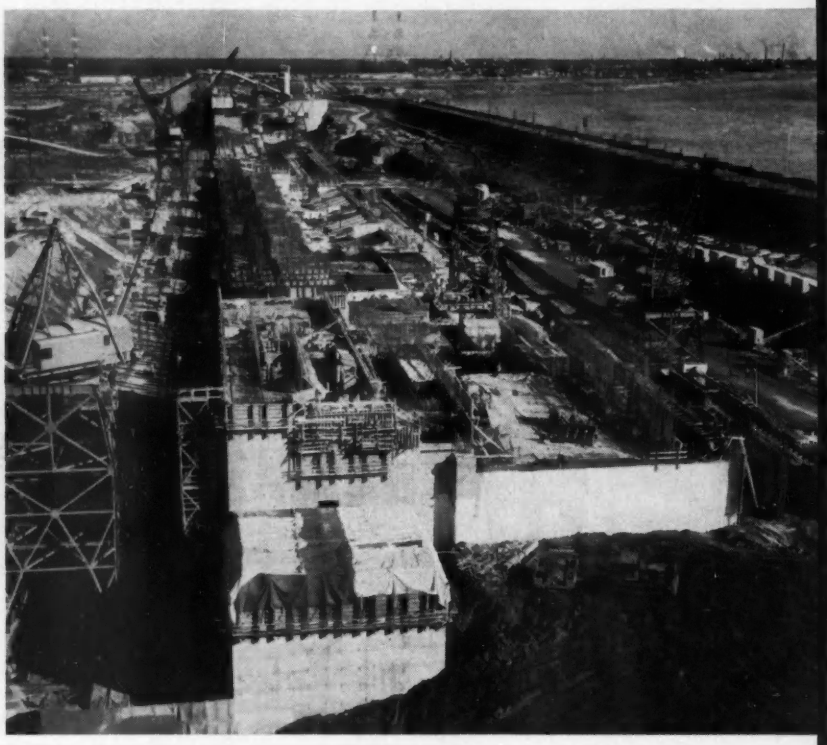
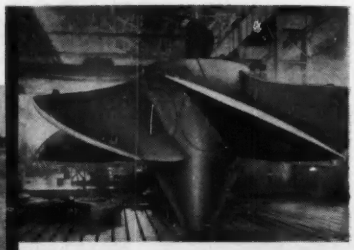
A-5205

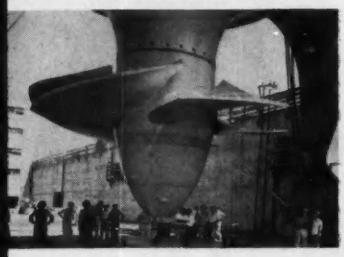
ELECTRICAL BUSINESS OUTLOOK

Overall view of the St. Lawrence Power Dam, Barnhart Island, N.Y. Here eight B-L-H fixed blade propeller turbines, each delivering 80,000 hp, will be installed. *Photograph courtesy Power Authority of the State of New York.*

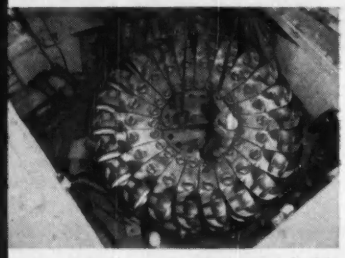




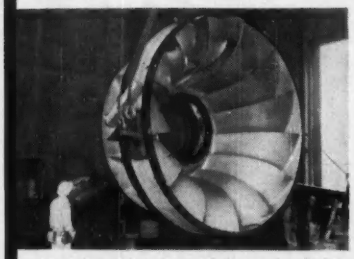
Balancing a fixed blade propeller runner for Wheeler Dam.



Adjustable blade propeller type runner being installed in TVA Fort Loudoun plant.



Impulse turbine runner being installed in the Kemano powerhouse of Aluminium Company of Canada Limited.



Francis turbine runner being unloaded in the Garrison Dam powerhouse.

One of 16 Kaplan turbine governors for The Dalles Dam.

4 reasons why B·L·H is your best source for turbines, pump-turbines and governors

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ELECTRICAL BUSINESS OUTLOOK

Electrical World
MARCH 11, 1957

The capital goods boom still appears strong. Manufacturers of heavy industrial equipment picked up a lot of new business in January. It shows up in McGraw-Hill's index of new orders for machinery, which rose from 131, seasonally adjusted, in December to 156 in January (1950 = 100). The index had been falling off during the closing quarter of last year (EW, Feb. 11, p 129).

Turnabout in the new orders index will soothe many business analysts who interpreted the slump in orders last year as the wind-up of the capital goods boom. This year, though, was bound to be good for manufacturers of heavy equipment. They started the year out with a large enough backlog of orders to make production for 1957, as a whole, good by any standards. But the drop in new orders raised doubts about prospects for the closing months of this year and 1958.

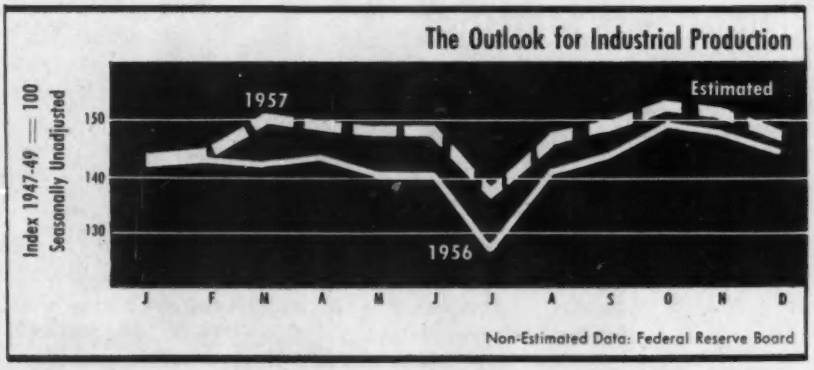
Federal Reserve Board's index of industrial production dropped from 147 in December to 146 in January (seasonally adjusted). The drop was concentrated largely in the durables sector. Production of nondurables, including chemicals, paper and rubber, remained firm. Production of crude oil and gas was up.

Actual production of durables in January matched December. The fact that the index slipped means that output did not rise as it usually does at this time of year. In some lines manufacturers were already operating near capacity, and could not raise production schedules. And there were also some cutbacks in production of electrical appliances. But for heavy equipment producers the pick up in new orders indicates continued high production schedules.

A sizeable chunk of capital goods output will go to electric utilities. As described in Electrical World's Statistical Issue (Jan. 28, p115), 40-million kw of generating capacity is on order through 1959. And some 20-million kw is planned for the next few years beyond '59. For 1957-59, U. S. electric utilities have already ordered 33% more capacity than they had spinning at the end of 1956.

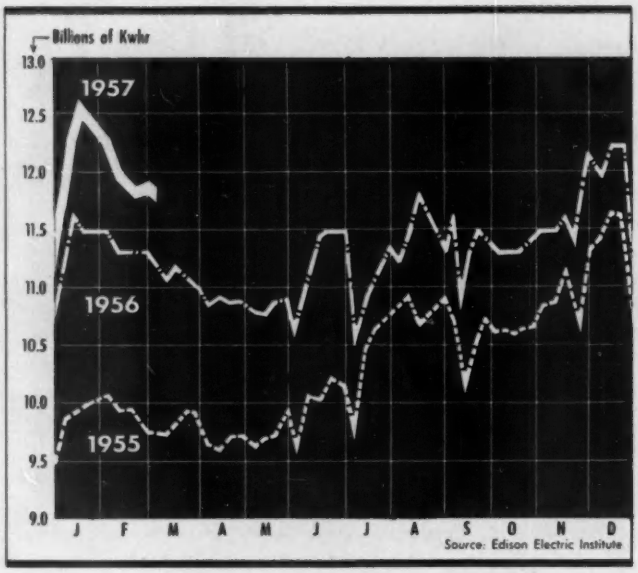
What's the added capacity going to cost? Well, this year new generation expenditures will hit about $2.2 billion. The added plant will be coming on the line in time to help meet the 714-billion kwhr sales expected in 1960. For comparison, last year's sales totaled 529-billion kwhr.

T&D will claim a big outlay, too. The transmission and distribution budget for the nation's utilities is close to $5 billion for the 1957-58 period.



MANAGEMENT BULLETIN

STATISTICS



OUTPUT

Week ended March 2, 11,791,000,000 Kwhr Up 5.3%

Per Cent Change From Previous Year

	Feb. 16	Feb. 23	Mar. 2
Total U. S.	+ 5.5	+ 5.7	+ 5.3
New Eng.	+ 5.9	+ 4.8	+ 3.9
Mid. Atlan.	+ 5.2	+ 3.3	+ 3.1
Cent. Ind.	+ 5.9	+ 6.0	+ 6.5
West Cent.	+ 7.5	+ 9.2	+ 9.1
Southeast	+ 6.7	+ 7.4	+ 5.9
South Cent.	+11.3	+10.8	+11.9
Rocky Mount.	+ 5.8	+ 8.5	+ 2.5
Pacific			
NW	− 6.4	− 2.9	− 4.9
SW	+ 5.0	+ 4.2	+ 6.0

Seasonally Adjusted Index 225.5
Week Ago 228.2
Year Ago 213.8

Atomic Eergy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 5.6%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	120.44	119.91	114.47	5.2
Peak—Class 1 Systems, million kw	Dec.	101.2	96.6	96.5	4.9
Estimated Dec. '57 Peak	Dec.	114.5	114.8	112.6	1.7
Production—billion kwhr	Dec.	52.88	50.65	50.82	4.1
Hydro		10.00	9.31	9.34	7.1
Fuel		42.88	41.34	41.48	3.4
Sales—billion kwhr	Nov.	45.78	45.98	42.96	6.6
Residential		11.66	11.27	10.74	8.6
Commercial		7.20	7.37	6.61	8.9
Industrial		24.51	24.79	23.28	5.3
Other		2.41	2.56	2.33	3.4
Fuel Consumption	Dec.				
Coal—million tons		14.73	14.03	14.81	−0.5
Oil—million barrels		8.22	7.13	8.55	−3.9
Gas—million cu ft		82.17	88.73	69.85	17.6
Net Income Class A & B Co's—$million	Nov.	102.54	95.79	102.79	−0.2
Residential Customers—millions	12 mos.	45.62	45.49	44.30	3.0
Revenue per kwhr	ended	2.60¢	2.60¢	2.65¢	−1.9
Avg kwhr per customer	Nov. 30	2,956	2,942	2,728	8.4
Avg annual bill		$76.86	$76.49	$72.29	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Jan.	145	144	143	1.4
ENR Construction Cost	Feb.	148.9	148.4	142.6	4.4
BLS Cost-of-living	Dec.	118.0	117.8	114.7	2.9
New Orders for Machinery (1950 = 100)	Jan.	152	138	135	12.6
NEMA Sales					
Insulation materials	Dec.	139	149	160	−13.1
Electric appliances		84	81	101	−16.8
Wholesale prices	Dec.				
Motors and generators		140.6	140.1	126.5	11.1
Transformers and regulators		146.6	146.6	131.2	11.7
Switchgear and fuses		163.9	164.4	147.5	11.1
GNP—annual rate—$ billion	4th Qtr.	423.8	413.8	397.3	6.7

MANAGEMENT BULLETIN continued

MANAGEMENT BULLETIN

FINANCE Electric utilities had only two security offerings last week. First was a competitive issue of $16 million Columbus & Southern Ohio Electric Co first mtge 4½% bonds (A) due 1987 which was won by the Dillon Reed group with a bid of 100,5899%; reoffered at 101.489% to yield 4.41%. Issue is reported going "very well." . . . Consumers Power Co sets per share price on its 549,324 common shares being offered first to commonholders on a 1-for-15 basis, record March 7 to expire March 22. Company asked for bids on underwriting the unsubscribed shares (see p 19 for price to shareholders and underwriting bid).

A check for $1,009,046.77 issued by the Electric Power Board of Chattanooga has been delivered to the Tennessee Valley Authority for electricity the board purchased during January. It was not only the largest ever issued by the board for power but also represented the largest amount ever paid by any one of the 150 distributors of TVA power for a month's electricity requirements.

Nashville, Tenn., City Council approves two bond issues of Nashville Electric Service, totaling $7.9 million for its expansion program.

Douglas, Ariz., residents vote March 26 on an offer of a 25-year franchise by Arizona Public Service Co to continue supplying electricity and gas.

LEGISLATION **A joint operating agency of 17 Public Utility Districts was organized** Feb. 20 at Seattle as the Washington Public Power Supply System. Grover C. Greimes, reperesenting the Clallam PUD, was elected chairman with Glenn C. Walkley of the Franklin PUD as vice chairman. System is made up entirely of PUD's but also can be joined by municipal power systems. It is the first agency to be authorized under a Washington state law, upheld in the courts, which permits utilities to cooperate in the construction, purchase and operation of generating and transmission facilities.

A bill that would set an ad valorem tax ratio on utility properties 30% higher than that applied to other properties is before the Oregon legislature.

New York state legislature gets bill that would allow PSC to regulate electric submetering in New York City.

North Dakota's House of Representatives approves bill aimed at defining the limits of areas of operation of electric utilities and co-ops.

A bill to broaden the regulatory powers of the State PUC to include fixing the rates of power and gas companies is introduced in the South Dakota legislature.

RATES **Maine's utility rate base procedure change is sought.** A campaign by the Maine Committee for Fair Utility Rates to initiate a legislative bill to change the procedure for fixing public utility rates fell about 6,000 signatures short of the required number, according to announcement recently by the Maine Secretary of State's office. If the drive had succeeded, the bill would have gone to referendum automatically if the state legislature defeated or amended it. The bill proposed utility rates be based on the "prudent investment" of the utility in operating property. Proponents contend that "current value" or "reproduction cost" of utility property should be used.

ACQUISITIONS **Sabina, O, Village Council gets temporary injunction** forbidding it to open a bid from Dayton Power & Light Co for purchase of town's power and water plants. Warren County Common Pleas Court rules village is not empowered to sell the municipal utilities without consent of Board of Public Affairs. Latter refuses to approve sale, arguing plant makes over $10,000 a year profit. When

How do you pick

any of the plant's four generators goes out (total 1,150 kw), users, especially three local factories, are asked to cut down. They have worked out a system whereby one will operate its machines in the morning and another in the afternoon.

An exchange of customers between Ellensburg, Wash., City Light and Puget Sound Power & Light Co has been authorized by the Ellensburg City Council. City will pay $148,075 for Puget's facilities serving 352 customers within the city. Puget will get municipal facilities serving 25 customers outside city.

LABOR RELATIONS

Seattle, Wash., Department of Lighting will be able to establish an apprenticeship system as the result of action by the Seattle City Council. Program, first in Seattle city government, will involve apprentice electrician constructors, linemen, and automotive machinists. Apprentices will start out at a pay scale of 67% of journeymen scales and progress through eight half-vear periods to 95% of journeymen's wages.

Where should management look for employees to run a new electronic computing section? Arizona Public Service Co found within its own ranks 80% of the 40 people needed to staff its Univac computer operation. These were drawn from 300 employees who applied for jobs in electronic data processing. Previous jobs of the staff for Univac include groundman, surveyor, and engineer.

Public Service Co of New Mexico has assumed entire cost of employees group insurance plan. It became effective March 1. Plan covers life insurance for each eligible employee, plus accidental death and dismemberment, hospital, surgical, and medical and major medical expense benefits. For dependents of all eligible employees, plan covers hospital, surgical and medical, and major medical expense benefits.

PUBLIC RELATIONS

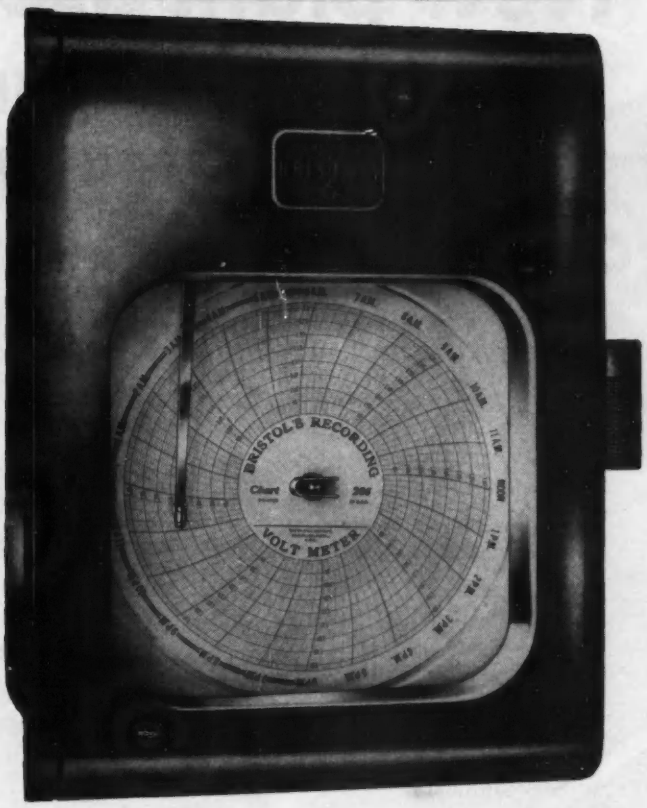
The intense cold in January may result in higher electric bills for residential consumers. After the middle of February, many customers may have forgotten the duration and intensity of the cold wave, and wonder why their service bills have gone up. To explain the reasons, Connecticut Light & Power Co has just published a booklet "Why Do Your Service Bills Vary." For copy write Paul Hayden, vice president, CL&P, New Berlin, Conn.

Five electric companies are cited for the Charles A. Coffin Award. Out of 32 candidates for the award, these companies have been chosen for final judging: American Gas & Electric Co, Cleveland Electric Illuminating Co, Consolidated Edison Co of New York, Idaho Power Co, and Ohio Valley Electric Co.

Annual reports for 1956 are beginning to come in. Six were received last week. The first was Florida Power Corp which had a very attractive cover with an outline of the state of Florida on it. The report contains a clear "Income and Outgo" chart which shows where the revenue dollar went. It is well illustrated with pictures and charts . . . The report of Cincinnati Gas & Electric showed that 12,196 women (45.9% of the total) held 1,541,768 common shares (21.6% of the total) at the end of 1956 . . . Baltimore Gas & Electric Co had an attractive two color report with an interesting ten-year table showing financial and statistical information about the company . . . "More electricity . . . more gas . . . ready NOW for Tomorrow's Wonders" is the theme of Dayton Power & Light Co's annual report. Photographs, layouts, and typography are appealing . . . Western Massachusetts Electric Co has an interesting chart on the diversification of industry served. It also has a picture of the new Yankee Atomic Electric power plant which will be built by utilities serving 90% of New England . . . Public Service Co of Indiana has an attractive black and white report. It is very readable and has a fine "Facts in Brief" page.

WHAT'S NEWS AT BRISTOL . . .

How do you pick the right recording ammeter or voltmeter?



PERMANENTLY MOUNTED Bristol Voltmeters and Ammeters come in three models: interchangeable surface and flush, surface-panel, and flush panel.

The *right* choice for any voltage or current measurement and recording job is a Bristol Series 500 instrument.

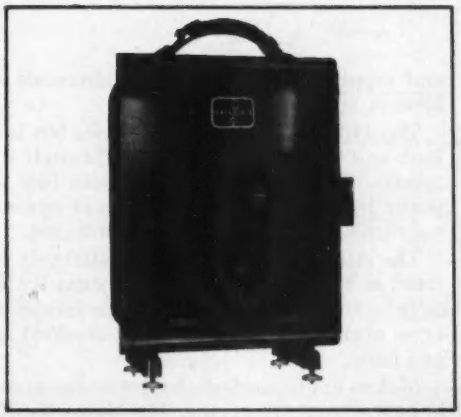
Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

1. Low burden – the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

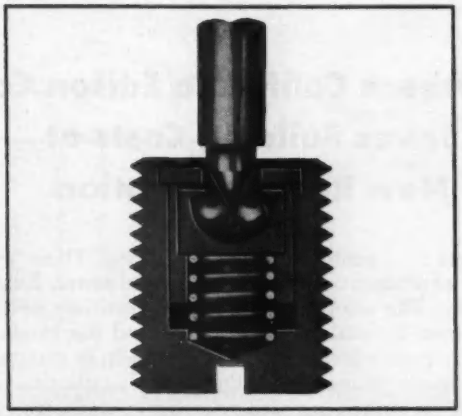
Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 5.19



SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.



NEW BALL-BEARING SUSPENSION, loaded by a coil spring, prevents damage even under severe mechanical shock. Corrosion-resistant stainless steel ball bearings are almost tool-hard.

BRISTOL

TRADE MARK BRISTOL'S REG. U.S. PAT. OFFICE

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

New plant uses for station

Southern California Edison Co. Saves Building Costs at New Redondo Station

Cut costs . . . maintain power continuity! These were the big considerations at Southern California Edison Company. The use of outdoor station auxiliary switchgear helped in cutting overall costs. And the carefully planned circuit schemes described here help in maintaining continuity of service for the station auxiliaries.

First step in assuring power continuity was setting up two independent power sources for auxiliaries.

(1) *An auxiliary generator direct-connected to the main generator shaft.* Supplies main auxiliaries during normal operation . . . provides a power source independent of system disturbances.

(2) *A local 69-kv line through a step-down transformer bank.* Provides a reserve and start-up source, and supplies general station requirements such as soot blowers and spare exciter.

The 4160-volt main station service bus is divided into East and West bus connected through a bus section breaker. Each section supplies about half the auxiliary power requirements. If either bus is removed, approximately 65% capacity can be maintained.

The Allis-Chalmers outdoor 4160-volt switchgear is rated at 250,000-kva interrupting capacity and is physically split as indicated by the one-line diagram. Three types of protection are provided: overload, undervoltage and fault.

Motors are tripped off the line and an alarm is sounded if heavy overload occurs. No alarm is given on light overload.

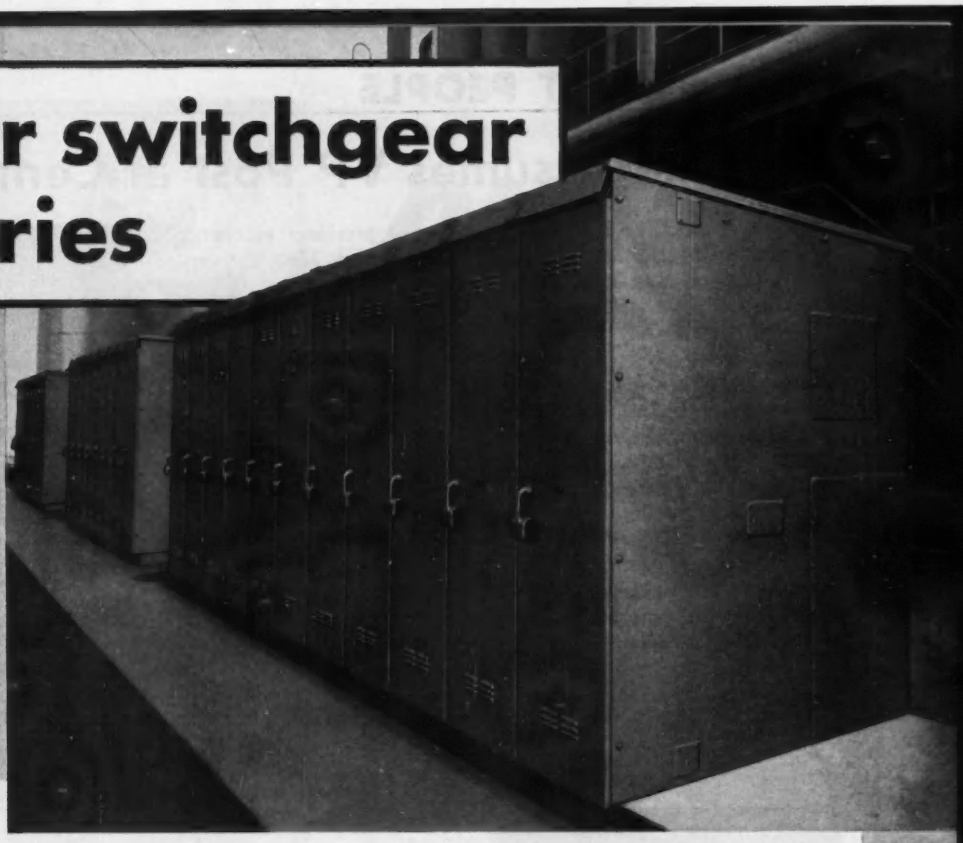
An undervoltage condition on main bus (East and West buses combined) will initiate an automatic throw-over from the auxiliary generator to the reserve supply.

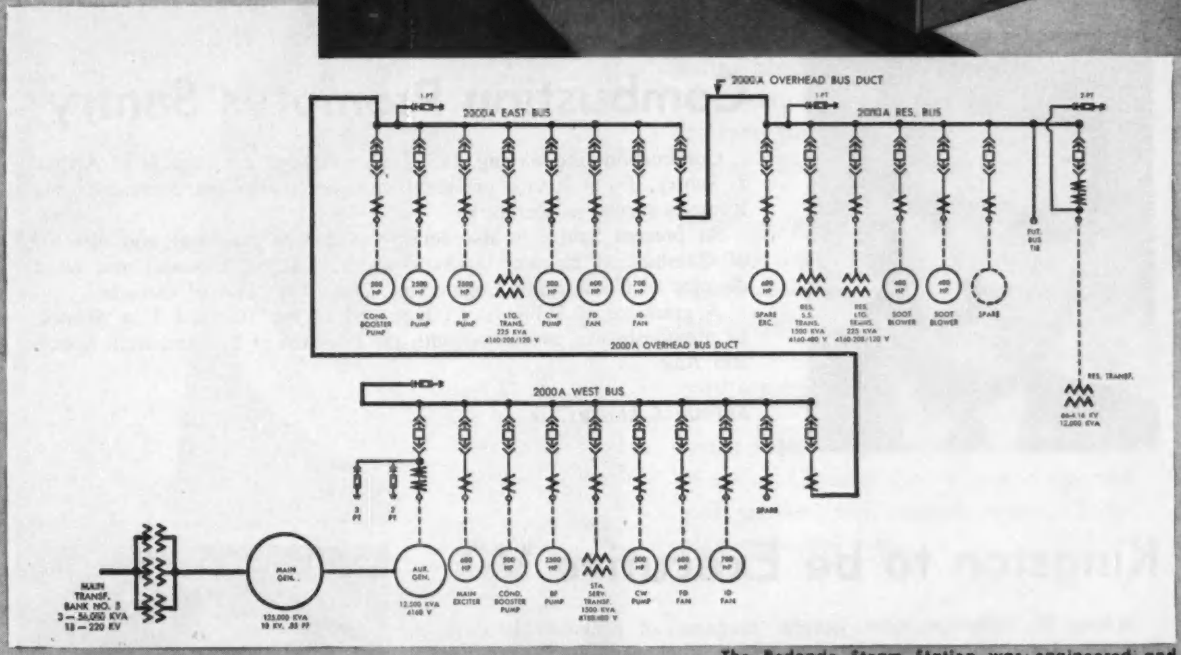
In the event of a fault in the generator circuit or in the generator, provision is made for automatic transfer from auxiliary generator to reserve source.

for Progress in Switchgear **ALLIS-**

outdoor switchgear auxiliaries

Allis-Chalmers engineers worked in close cooperation with Stone & Webster Engineering Corporation and Southern California Edison Company engineers on this project. It is one of many station auxiliary switchgear lineups built by Allis-Chalmers. For an answer to your switchgear problems, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.





The Redondo Steam Station was engineered and constructed by Stone & Webster Engineering Corporation.

If there's a fault on either the East or West bus, the section is automatically isolated so disturbances will be kept to a minimum.

During normal operations it is possible to transfer to the reserve supply by first opening the normal supply — then closing the reserve bus tie.

To provide added flexibility there is also provision for make-before-break manual transfer from normal to reserve power supply by closing the reserve bus-tie breaker, after synchronizing the two sources of power, and then opening the normal supply breaker.

CHALMERS A-C ALLIS-CHALMERS

A-5217

Doolittle Assumes VP Post at Central Hudson

J. Ernest Doolittle has been elected vice president in charge of commercial relations of Central Hudson Gas & Electric Corp. In his new position he will succeed Harris E. Dexter, whose retirement became effective March 1.

Doolittle, who has served as assistant vice president of the company since 1954, is a veteran of more than 33 years with Central Hudson. He came to the utility in 1923 as a cadet engineer at Poughkeepsie (N. Y.).

In 1924 he was transferred to the company's Kingston operating district and was advanced to the position of operating superintendent of the Beacon district two years later.

He returned to Poughkeepsie in 1927 as Division Commercial manager and remained in that post until his 1929 appointment as Poughkeepsie district manager.

Doolittle is a 1923 electrical engineering graduate of Rensselaer Polytechnic Institute and is a member of the New York Society of Professional Engineers.

J. ERNEST DOOLITTLE

Combustion Promotes Santry

Combustion Engineering, Inc, has announced the election of Arthur J. Santry, Jr, as a vice president and director of the company. He formerly served as secretary.

At present Santry is also serving as a vice president and director of Combustion Engineering-Superheater, Ltd, of Canada, and as a director of Combustion Engineering Corp, Ltd, also of Canada.

A graduate of Williams College and of the Harvard Law School, he previously was associated with the law firm of Putnam, Bell, Santry and Ray.

ARTHUR J. SANTRY, JR

Kingston to be Executive VP

Walter E. Kingston, now general manager of Sylvania Electric Products, Inc, has been appointed to assume the position of executive vice president of Sylvania-Corning Nuclear Corp upon its formation in the near future.

Kingston's 26-year career with Sylvania has been devoted principally to the metallurgical field. In 1938 he was named chief metallurgist in charge of metallurgical research and development for tube operations. He became manager of metallurgical research in 1943. Soon afterward the laboratory which he headed began work on special metallurgy problems for Atomic Energy Commission. When Sylvania's Atomic Energy Division was formed in 1952, Kingston was appointed its general manager.

WALTER E. KINGSTON

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CABLE TAPES

for tighter... neater...stronger bindings!

Better binding is just one of the many jobs being accomplished with ease and economy through the use of quality controlled Chase Cable Tapes.

Whether you need binding tapes, insulating tapes, semi-conducting tapes, ozone-resistant tapes, heat-resistant tapes, high dielectric tapes or flame retardent tapes . . . Chase can meet your requirements!

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Western Precipitation Corp VP's McGrane

NORMAN N. McGRANE

Western Precipitation Corp has announced the election of Norman M. McGrane as vice president of the company.

In his new position McGrane will act as staff advisor to Alfred W. Knight, executive vice president, on all technical and engineering matters, especially in the fields of recovery of dust, fume, and fly ash from industrial gases.

McGrane, also a member of the executive committee and a director of Western Precipitation, has been with the company for more than 30 years. In his most recent post he served as chief technical engineer for Cottrell, Multiclone, CMP, and Dualaire lines. He is a graduate of the University of California.

PERSONAL BRIEFS

A. D. Caskey has been appointed assistant manager of engineering for Commonwealth Edison Co.

The operating department of Central Illinois Public Service Co has announced the appointment of two supervisors. **Harry C. Wilson,** formerly sub-station engineer in the Southern Division, is now system communication engineer in charge of a new communication-telemetering section. **Herman J. Talken,** formerly assistant electric meter engineer at Springfield, is now electric meter engineer in charge of electric metering section to succeed **H. W. Berning** who retired recently.

Carolina Power & Light Co has named **Joseph H. Henry** planning engineer at its Raleigh, N. C., headquarters offices.

Francis F. McDermitt, Sr, has been appointed chief investigator, legal claim department, coordinated transport, Public Service Electric & Gas Co. He succeeds **J. Elmer Carroll,** who retired. **John P. Mahoney** has been appointed assistant chief investigator.

Leo J. Skyles, assistant superintendent of electric distribution, Peoples Gas & Electric, retired after 35 years of service.

Potomac Electric Power Co has designated **Aaronson E. Stant** assistant purchasing agent in the purchasing and stores department of the utility.

Personnel assistant at Baton Rouge, **J. R. Murphy,** has been appointed to the newly created position of supervisor of industrial relations for Gulf States Utilities Co . . . Vice president **Henry V. Faber,** a veteran of 37 years with Gulf States Utilities, retired March 1.

Joseph F. Nigro was recently designated to serve on the Public Utilities Commission in Colorado for a six year term.

Ohio Power Co has named **Houston E. Crouse** manager of the new Kammer plant at Captina, W. Va.

(Continued on page 174)

CIPS Advances LeForge

F. Gerald LeForge is newly named superintendent of Central Illinois Public Service Co's Grant Tower station. LeForge, previously assistant superintendent at the plant, succeeds Leslie K. Jackson, who retired recently.

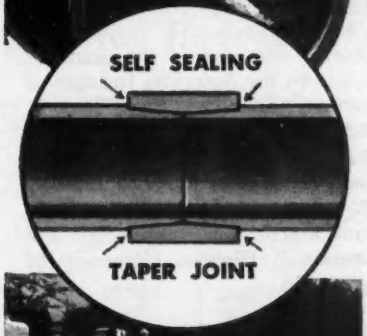
The plant which LeForge now heads will have a capacity of 225,000 kw upon completion of a new 100,000-kw generating unit at the end of this year.

BPA's Conkling Honored

Roger L. Conkling, director of budget and management for Bonneville Power Administration, has been named winner of one of ten Arthur J. Flemming annual awards to outstanding young men in federal government.

BPA Administrator William A. Pearl recently cited Conkling for his "outstanding work in developing programs for wheeling nonfederal power and sale of secondary power."

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

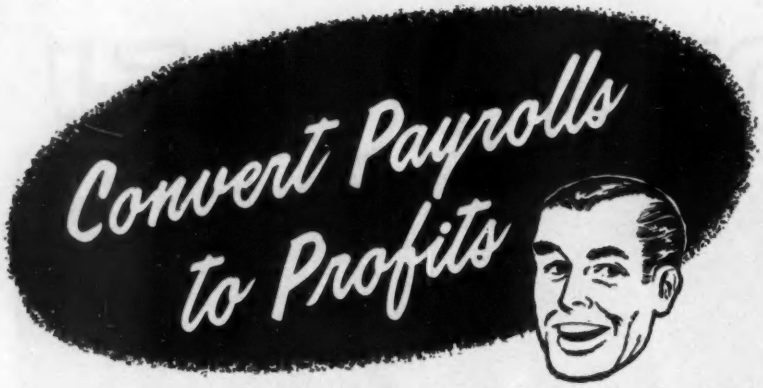
Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT. EW-37 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

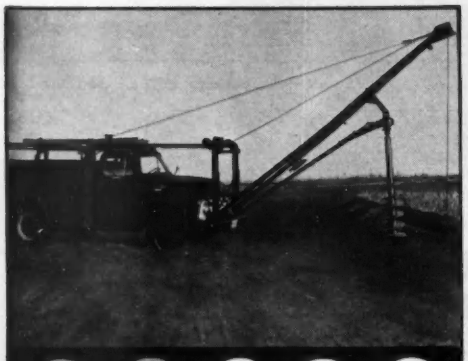
ORANGEBURG®
FIBRE CONDUIT



Tel-E-Lect's complete line of front operated equipment now enables utility companies to do twice the amount of work with smaller crews in just half the time. If you're still using 5-man crews on obsolete utility equipment (even on a new chassis), you have extra men on the payroll that can be making a profit for you on another job. Tel-E-Lect builds the services of three men into its utility truck equipment. Now, *two men* can do the work once done by five!

Adaptable to all makes of popular trucks, Tel-E-Lect quality-built front operated equipment is fast and versatile. The simplicity of operation of its winches, digger drive kits, FLD units, derricks, diggers and augers make them efficient and economical—require smaller crews to operate, thus freeing men for other jobs and for big, highline work.

After just *two minutes* on location, the digger and derrick are ready to go to work. Digger and derrick equipment are brought into working position by simply engaging winch line. The digger remains attached to the derrick and is raised or lowered by actuating a single lever in the cab. The load line is now available for pole setting. When digging in hard soil or frozen ground, the weight of the pole may be used as ballast for additional auger pressure.



Tel-E-Lect equipment saves three men out of five for other work.

These men are now available for other important jobs!

Compact, custom-built bodies and utility equipment by Tel-E-Lect are capable of handling the major portion of Telephone and Power Co. work. This unit is shown with derrick and digger stowed overhead for travel.

Write for literature on Front Operated Equipment

TEL-E-LECT PRODUCTS, INC.
10003 Minnetonka Blvd.
Minneapolis 26, Minnesota

Personal Briefs

(Continued from page 172)

William Avery has retired as special assistant to the comptroller of Union Electric Co after more than 54 years continuous service with the utility . . . Commonwealth Edison Co's **Dan A. Sullivan** has retired to become a consultant with Armour Research Foundation of Illinois Institute of Technology.

Ralph T. Catterall has been elected chairman of the Virginia State Corporation Commission. He succeeds **W. Marshall King** under the SCC's annual rotation plan.

William E. Stinchfield, chief of civil projects section, Seattle District, Army Corps of Engineers, has been appointed resident engineer at Chief Joseph Dam.

Pacific Power & Light Co has transferred **Merl Ebbe** from district manager at Kalispell, Mont., to a staff position in Portland, Ore., and has appointed **Robert S. Gordon** to succeed Ebbe.

William M. Jack, Cheyenne investment broker and former state auditor, has been appointed to a six-year term on the Wyoming Public Service Commission.

Recently elevated to the grade of Fellow by the American Institute of Electrical Engineers were **Earl F. Mekelburg,** Square D Co; **John A. Potts,** Wisconsin Electric Power Co; **Leon T. Rosenberg,** Allis-Chalmers Mfg Co; **Fred J. Van Zeeland,** Milwaukee School of Engineering; and **Thomas J. Higgins,** University of Wisconsin.

George Artus, formerly assistant superintendent of the Shuffleton Steam plant, Puget Sound Power & Light Co, has been moved up to fill the top position at Shuffleton, following the retirement of **Harry Waldorf.**

Public Service Co of Indiana, Inc, has announced the appointment of **Robert W. Johnston** to succeed **Edward D. Dieselberg** as manager of the Batesville area of the Greensburg district. Dieselberg died recently in Cincinnati.

(More Personal Briefs on page 176)

New Westinghouse OV-35

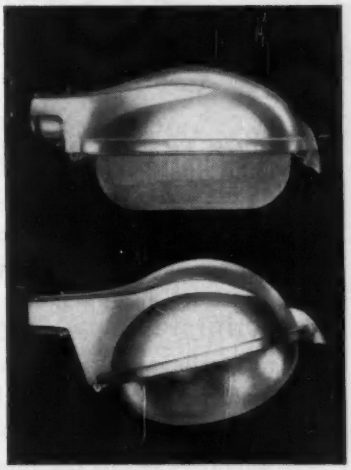
. . . the first luminaire designed specifically for fluorescent mercury lamps

Westinghouse, pioneer in the development of mercury street lighting — the OV-20 and OV-60 — now presents the OV-35 luminaire which can be used with the 400-watt J-H1 or the 700-watt B-H18 fluorescent mercury lamps.

This third member of the Westinghouse mercury group now offers you a complete selection of mercury luminaires for any roadway application — regardless of width or traffic conditions.

The new OV-35 is the first street-lighting luminaire to include a completely sealed optical system — bugs, dirt or moisture cannot get in. Like the OV-20 and the OV-60, this new luminaire assures the best possible night visibility and a greater uniformity of pavement brightness.

Whatever your roadway lighting requirements, be sure to specify Westinghouse mercury luminaires. More information? See your nearby Westinghouse representative. Or, write Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio. J-04405-A X



The Westinghouse OV-20 (top) and OV-60 (bottom) now offer you a complete selection of mercury luminaires for any roadway application.

YOU CAN BE SURE...IF IT'S

Westinghouse

NOW DO MORE WORK WITH ANY LINE TRUCK

GREATEST OPERATING RANGE OF ANY PINLESS DERRICK

SINGLE CYLINDER—PISTON ROD TOTALLY ENCLOSED

POSITIVE LOAD CONTROL IN ALL POSITIONS

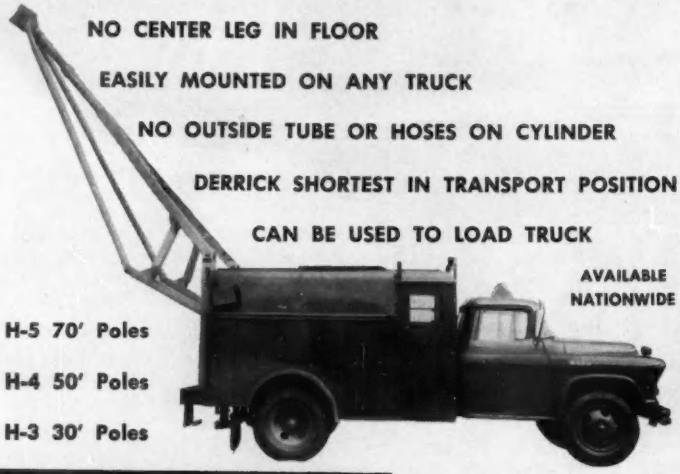
NO CENTER LEG IN FLOOR

EASILY MOUNTED ON ANY TRUCK

NO OUTSIDE TUBE OR HOSES ON CYLINDER

DERRICK SHORTEST IN TRANSPORT POSITION

CAN BE USED TO LOAD TRUCK



AVAILABLE NATIONWIDE

H-5 70′ Poles

H-4 50′ Poles

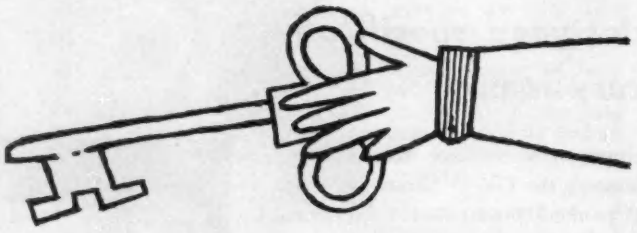
H-3 30′ Poles

AMERICAN TRUCK EQUIPMENT CO.

MANUFACTURERS

PORTLAND, ORE. • OAKLAND, CALIF.

HYDRAULIC DERRICKS • ALL ELECTRIC HALL AERIAL LADDERS • UTILITY MAINTENANCE AND CONSTRUCTION BODIES AND HALL HYDRAULIC AND MECHANICAL EARTH BORERS



You've got the key in your hand . . .

the key that unlocks the tremendous market potential of the Electric Power Industry . . . whoever you want to reach, no matter which segment of this complex, expanding market they're in. ELECTRICAL WORLD's audience of more than 26,000 *all-paid* subscribers is the bone and marrow of the entire industry—the key people wherever electricity is generated, transmitted, distributed or utilized in large amounts. Want the whole story . . . the real significance of WORLD's audience to you? Simple. Write today for "Quick Facts". . .

ELECTRICAL WORLD

330 W. 42nd St., New York 36, N. Y.

J. H. Gerlach has been promoted to plant superintendent in charge of operations at the Acme station of Toledo Edison Co. **D. J. Roux** has been named superintendent of heavy maintenance for the company.

National Farm Electrification Conference has announced the election of the following officers for 1957: **W. J. Ridout, Jr,** chairman; **H. S. Pringle,** first vice chairman; **H. H. Watson,** second vice chairman; **Russell Gingles,** secretary; **Karl H. Gorham,** treasurer.

In Massachusetts, **Richard H. Lee** was named counsel for the Department of Public Utilities replacing **Edward N. Gadsby,** who retired. **Herbert Baer** was named assistant counsel.

Ethel Lord has been named director of the Home Service department in the combined sales operations of Jersey Central Power & Light Co and New Jersey Power & Light Co.

OBITUARY

Dr. Francis J. Adams, 76, professor emeritus of electric engineering, Worcester Polytechnic Institute, who retired in 1956 after 52 years of service, died recently.

L. K. Baxter, 62, general service manager of Westinghouse Electric Appliance Divisions, died suddenly at his home following a heart attack.

William Fitzhugh Ficklen, 69, a retired vice president of the American Gas & Electric Co, died at his home in Charleston, West Virginia.

George Miller, 84, sales manager of the Cleveland Electric Illuminating Co from 1911 to 1943 and the first president of the Electrical League of Cleveland, died recently at his home.

Irving E. Moultrop, 91, former chief engineer and superintendent of construction for Boston Edison Co, died recently in retirement.

David M. Salsbury, former president of Westinghouse Electric Supply Co, died recently following a heart attack in Honolulu.

TVA Business . . .

. . . boomed in 1956 with 11% increase in energy sales, and 9% in revenue

Distributors of Tennessee Valley Authority power sold 15,026,000,000 kwhr of electricity during the calendar year 1956, for which they received $157 million, TVA reports.

Included are 98 municipally owned systems, 51 cooperatives, the city of Oak Ridge, and two small private companies.

This represents an increase of 11% in energy sales and 9% in revenue over the preceding year. Residential sales, amounting to 7,520,000,000 kwhr continued to show the largest increase in use of any of the classes of service.

Average annual residential use reached 5,921 kwhr, an increase of 491 kwhr during the year and about double the national average of 2,975.

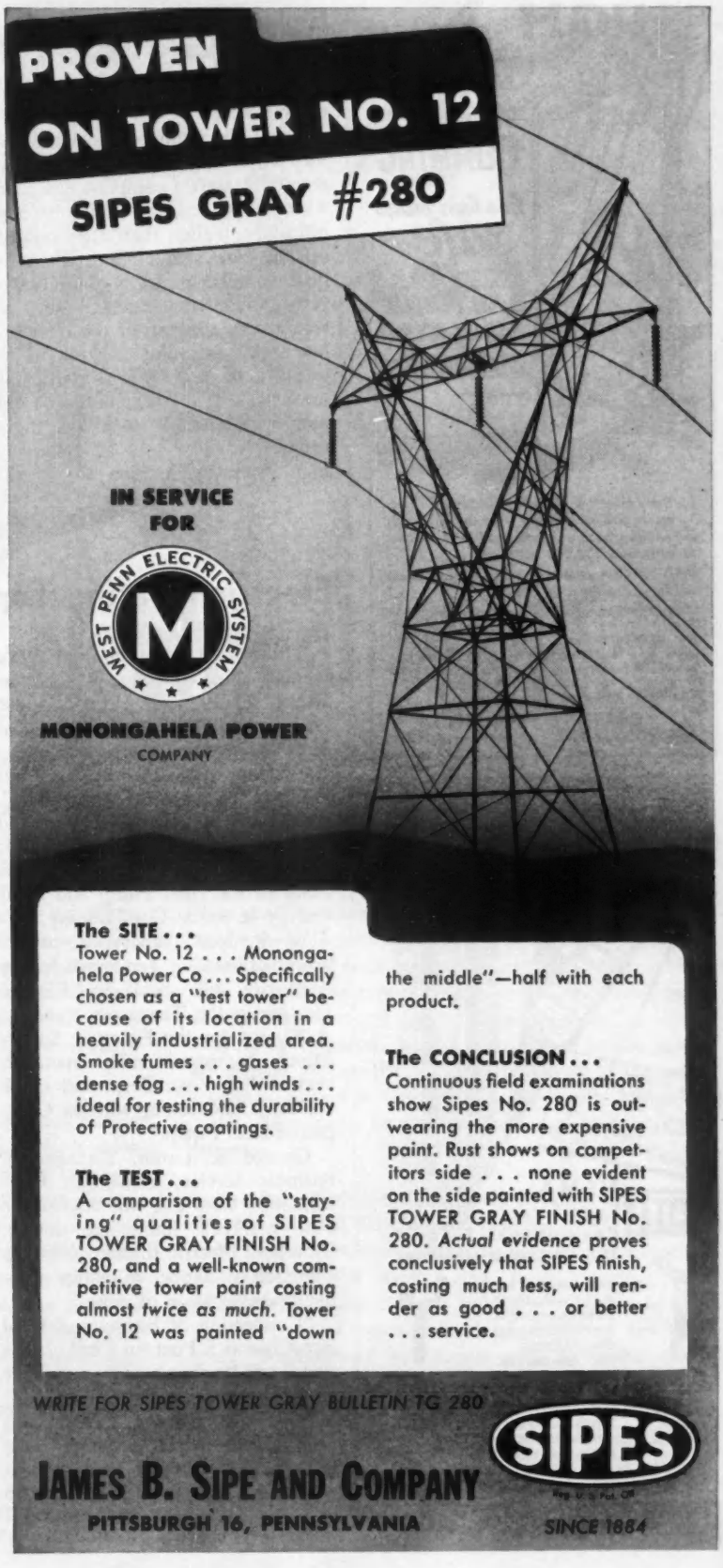
The area's average residential rate of 1.16 was less than half the national average of 2.6¢.

Forty-six thousand new consumers were added during the calendar year, bringing the number of consumers served as of Dec. 31 to 1,457,864, an increase of 3.3%. The 1,891,000,000 kwhr used on farms served with TVA power represents an increase of 13% over the previous year.

During the year the number of houses in the TVA power service area that are completely heated with electricity increased by nearly 22,000 to a total of approximately 177,000. Many of the nation's electric utilities which in the past had for the most part discouraged electric heat now are aggressively promoting this load in view of the favorable experience in the TVA area.

I&M Signs Contract

A contract has been awarded for general construction work at Indiana & Michigan Electric Co's new 450,000-kw Breed Plant, on the Wabash River in Sullivan County, Ind.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Higher Interest Rates

(*Continued from page* 91)

current capital costs were substantially lower.

From the common stockholders' viewpoint, it is the future that counts. Unless a company can earn a return on capital additions significantly higher than the interest rate on new senior funds, there is little inducement for the equity investor to assume responsibilities of capital management or the risks inherent in his junior position. This would seem to apply with particular force to rapidly expanding companies. Common stocks of these utilities usually sell at relatively high prices in relation to current earnings in obvious expectation of increasing earnings as the business grows. This expectation can hardly be realized if over-all permitted return only narrowly exceeds cost of senior capital.

Common stock prices, and willingness to buy common stocks, are based primarily on the degree of confidence with which investors view the future. If this confidence should weaken, due to concern as to whether an adequate margin of equity earnings will be maintained, there would develop a real question as to the industry's ability to continue raising additional equity capital. Consequences of this to the country's economic growth could be serious.

Electric Heating Topic on APC Program

The American Power Conference is slated to convene in Chicago March 27-29 with electric house heating and the future of the coal industry as prime topics.

Heading a trio of speakers dealing with space heating will be R. C. Jordan, chairman of the mechanical engineering dept, University of Minnesota. He will discuss "The Place of the Heat Pump and Solar Energy in Space Conditioning."

W. R. New, supervisor, div of power utilization, Tennessee Valley Authority, will speak on "Electric Heating in the Tennessee Valley—A Pattern for the Future." Sidney Miner, industrial sales manager, central dist, York Corp, will speak on "Air Conditioning with the Compound Heat Pump."

George S. Lamb, manager of business service, Pittsburgh Consolidation Coal Co, will discuss the coal market's immediate future. Cleveland Electric Illuminating Co's Clarence A. Dauber will cover pipeline transportation of coal.

"Conversion of Bituminous Coal into Char as a Fuel for Central Stations" will be discussed by a speaker yet to be announced.

Other slated topics: Central station steam generators, water technology, EHV systems, employment conditions, steam turbines, hydro power development, electronic applications, electrical distribution, central stations, gas turbines, electric power research, condenser and feedwater circuits, digital computers for mechanical problems, nuclear energy, industrial power plants.

Gallatin Unit Fixed, May Be Running in May

Gallatin, Tenn., steam plant's original generator, damaged shortly after the unit began operating last August, was back here again after repairs at Pittsburgh, Pa.

Westinghouse Electric Corp, the manufacturer, shipped the defective stator of the generator back to the factory. When another generator, which had been ordered for Unit No. 2, arrived at Gallatin, it was installed as the first unit and commercial output began in October.

Tennessee Valley Authority technicians have begun installing the repaired 250,000-kilowatt generator and officials said they hope it will begin operating by May 1.

TVA engineers said the original stator was damaged when a Westinghouse erector connected a shorted temperature recording device into the generator. The result was overheating and coil burn-outs. The stator weighs nearly 250 tons and cost $1.5 million.

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You are now reading the NEW end-product of 82 years of publishing service to the electric power industry. We'd like to think it's perfection itself, but we know better. It's only as good as we can make it, and it probably won't even retain its present format for any great length of time, if past experience with our readers is any criterion. For Electrical World, now, is as accurate an answer to your wants and needs — in total, the requirements of our industry — as we can make it. *When those requirements change, so too will Electrical World.* But to make sure that you get from our new make-up everything that's been put here for you, let's take a fast tour of the changes we've made.

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Then there's the *second* yellow-stock insert, at the back of the book. In this one you'll find our exclusive "Electrical Business Outlook." We believe (because you've told us so) that our "EBO" page, as it's coming to be known, is *the best interpretation of what is important to management to be found in the industry.* Accompanying Electrical Business Outlook will be the statistics — the weekly output chart, as well as power and general business statistics. Here you'll see industry progress defined as it takes place, by the week, in terms of capacity, peak load, production, power sales and customers, accompanied by general business statistics for easy comparison. Too, you won't want to miss the special page, "Atomic Progress," a rapid-reading view of latest developments on the nuclear power front. And in "newsletter" form, treatment of the problems management is constantly concerned with: Financial, Rates, Regulation, Public Relations, and Industrial Relations.

Larger type throughout the whole book is the order of the day, dictated like all other changes by the very real need for a faster, more efficiently read weekly magazine. With all this will come a new, more complete, more descriptive Contents Page; a Publisher's Column, to keep you informed of coming editorial features and new services; "Washington" will appear as a new, every-week run-down on the industry scene in the capitol. *Put all this on a firm foundation of the most complete, intensive reporting coverage available to any business publication, and you'll see why, more than ever before, Electrical World has earned the right to be known as . . .*

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